PUBLIC WORKS

Devoted to the interests of the engineers and technical officials of the cities, counties and states

SEPTEMBER, 1937

A. PRESCOTT FOLWELL, Editor — VOL. 68, NO. 9 — W. A. HARDENBERGH, Asso. Editor

Contents

TIMEWASTERS

Either the artist or the engraver has fallen down, for as yet we have no picture of what a "timewaster" looks like. We think we know the reason. With malice aforethought, we gave the artist copies of our December and July issues. The first contained Mr. Blunk's dog and fox problem; the second Mr. Bevan's uphill problem. It ought to take an artist from now until the first of the year to work out those two.

We note with regret that the "Power Specialist" has ceased to run their problem page. Out of ammunition, or was the heat too much?

An Old One:

Mr. Morrow, from Batesville, Ark., sends this one: Assuming the earth to be a smooth surfaced sphere, 24,000 miles in circumference at the equator, encircle the same with a snugly fitting band; then add 5 feet to the length of the band. How much space will there then be between the earth and the band, provided the band is evenly spaced? We had one like this some four years ago, but it's a good one, and maybe some of the newcomers to our ranks haven't seen it.

A Labor Day Problem:

A guest who arrived two hours late explained: "We had a blowout one hour after leaving home, and had to continue at three-fifths of our speed. If the accident had occurred 50 miles farther, we would have arrived 40 minutes earlier." The problem to be solved is: How far did the guest come? By *Mr. Potter* of Chicago, via *Link-Belt News*.

A Hemisphere of Rock:

A climber approaches from the north a hemisphere of rock, radius 1300 ft., and climbs it on a path leading to the right, with a maximum grade of 5 ft. rise in 12 ft. horizontal. What is the length of the shortest path to the zenith and in what direction is he traveling when he approaches the zenith? Contributed by *Mr. John Howard Anderson*, who says that he would like some of the expert TW's to provide him with a mathematical solution of the direction.

Some Solutions:

The boy who cut the cardboard square out of the corner (See August issue) had to be careful to get exactly 4.856 inches, or he didn't get the full capacity of 2101.890949 cu. ins. As to the foreman and his job, well he had to hire 13 more men to finish up the job in that last remaining day. W. A. H.

SUBSCRIPTION RATES: United States and Possessions. Canada, Mexico and Cuba, $3.00. All other countries, $4.00. Single Copies, 35 cents each.

FOUNDED IN 1896

Published monthly by the PUBLIC WORKS JOURNAL CORPORATION, 310 E. 45th St., New York, N. Y. J. T. MORRIS, *President;* W. A. HARDENBERGH, *Vice-Pres.;* CROXTON MORRIS, *Treasurer. Advertising Manager,* ARTHUR K. AKERS, 310 East 45th St., N. Y. *Advertising representatives,* FRED R. JONES, 228 No. La Salle St., Chicago, Ill.; ALONZO HAWLEY, 1635 E. 25th St., Cleveland, Ohio.

Turn to pages 55-57 for descriptions of helpful booklets and catalogs.

PUBLIC WORKS
City, County and State Engineering and Construction

SEPTEMBER, 1937
VOL. 68. NO. 9

An Automatic Water Softening Plant

First Installation of Zeolite Process in Florida Produces Excellent Results and Demand for Water Grows Steadily

By W. AUSTIN SMITH
Consulting Engineer, Jacksonville

THE Hollywood water softening plant is of particular interest as it is the first municipal water softening plant of the zeolite type to be installed in Florida. This plant has been in continuous operation since last August and the results that have been obtained are excellent.

W. Austin Smith

The water supply is drawn from three wells of an average depth of 120 feet, and analyses have shown that the three well waters are practically identical in composition. This water has an average hardness of approximately 17 grains per gallon, expressed as calcium carbonate. The hardness is due mostly to calcium bicarbonate, there being only about two grains of magnesium hardness present and about the same amount of non-carbonate hardness.

The iron content is low, about 0.3 ppm., expressed as iron, but the water from the wells does contain some hydrogen sulphide and aeration is, therefore, necessary. The aerator is mounted on the top of a storage tank of 100,000 gallons capacity. Formerly the well pump elevated the well water to the aerator, on top of the storage tank. The water dropped from this aerator into the storage tank and then flowed, by gravity, to the pump house, where it was chlorinated and then pumped to the city mains by means of high service pumps.

While this water was entirely satisfactory for drinking purposes, its hardness made it undesirable for other purposes and it was decided to soften it to approximately 5 grains per gallon. In selecting the method of softening and the type of equipment to be employed, a close study was made of the relative costs and applicability of the cold lime alum process and the zeolite process.

This study showed that the lime alum process, due to its higher initial cost under the conditions at Hollywood, its sludge disposal problem and its higher total costs for attendance and operation, was not so applicable as the zeolite process. With the zeolite process, the initial cost was lower; the sludge disposal problem was eliminated; the total cost for attendance and operation was lower and it could be installed very simply by placing the zeolite water softeners between the elevated storage tank and the service pumps.

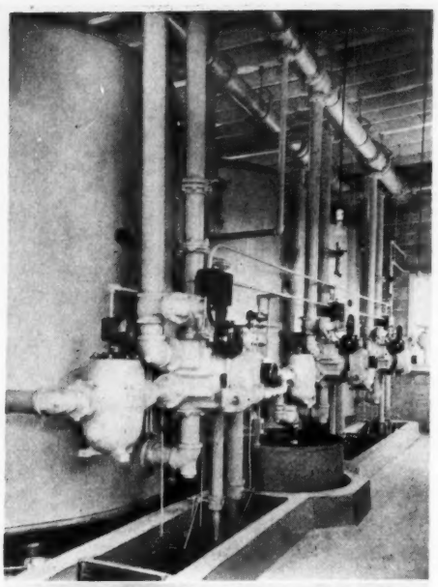
Furthermore, it was decided that a completely automatic zeolite water softening plant would be much more desirable than a manually operated plant. The automatic plant would eliminate the possibility of incorrect operation, due to the human factor; would minimize the amount of attendance required; would assure the highest degree of utilization of the salt required for regeneration and would prevent the possibility of undue amounts of water being used for backwashing and rinsing operations.

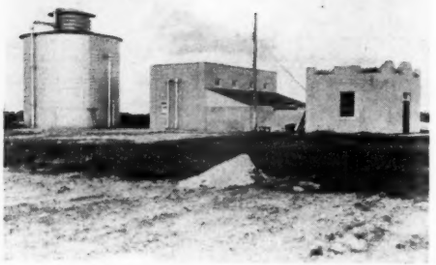
Specifications for this type of plant were accordingly drawn up and, after approval by the P. W. A. authorities was secured, bids were called for. The successful bidder was the M. and M. Construction Company of Miami, and the softening equipment was furnished by the Permutit Company of New York.

The plant consists of one 11′ diameter x 6′ steel coke aerator; three 9′ diameter x 10′ Permutit vertical type automatic zeolite water softeners; one 48″ diameter x 48″ brine measuring tank; and one concrete wet salt storage basin. It is equipped with automatic by-pass valves and rate-of-flow indicators. The type of zeolite employed is super-zeo-dur, which is a high capacity, green sand base zeolite.

The equipment is housed in a new building 46 feet long by 33 feet wide by 22 feet high. This building was erected on ground located between the storage tank and the pump house.

This plant will soften 1,500,000 gallons per day of water having a hardness of 17 grains per gallon, producing a mixed effluent having a hardness of 5 grains per gallon. Room was left in this building to accommo-





Two views of Hollywood's new softening plant. In the upper picture are the completely automatic valves and equipment used in the softening process. In the lower picture, from left to right, may be seen the reservoir and aerator, the softening plant and brine storage tanks, and the pumping station

date, whenever required in the future, a fourth water softening unit, which would increase the capacity to 2,000,000 gallons per day.

Zeolite functions by base-exchange and, in softening water by this process, it is merely necessary to pass the flow of water through a bed of granular zeolite, held in a suitable container. The removal of the hardness is practically complete, so the effluent of a zeolite plant is practically zero in hardness. Therefore, in order to soften a 17-grain water to 5 grains, twelve-seventeenths of the water is softened through the zeolite water softener units and five-seventeenths is by-passed around them and mixed with the softened water.

Therefore, in softening the Hollywood water, twelve parts of completely softened water are mixed with five parts of hard water, thus yielding water with a hardness of 5 grains per gallon. Also, if at some future date it might be desirable to produce a somewhat softer water, this could easily be accomplished by softening a relatively larger proportion of the water and mixing this with a relatively smaller proportion of the hard water. In this way, the plant provides a high degree of flexibility. At Hollywood, this proportioning of the water is accomplished by means of automatic by-pass valves.

The automatic operation of the water softening units is accomplished by means of a motor-driven multiport valve, the rotation of which to the various settings is accomplished by means of electrical controls. Briefly, the volume of water softened on each softening run is measured and governed by means of a water meter, equipped with an electrical contact head.

At the end of the softening run, the meter makes an electrical contact, establishing a current which actuates a small motor mounted on the valve. The motor rotates the valve to the backwash position, at which point the contact is automatically broken and the motor stops.

The length of the backwashing period is governed by an adjustable time-switch, and the rate of flow of the backwash water is governed by a butterfly valve operated by the level of the water behind a fixed orifice plate in a sump.

At the end of the backwash period, the motor is again automatically actuated so as to rotate the valve to the brine position. Then, by means of a hydraulic ejector, a predetermined amount of a saturated solution of common salt is injected into the softening unit. The salt acts on the zeolite causing it to give up its calcium and magnesium content, in the form of the very soluble chlorides, which may be discharged into any convenient drain.

The equivalent amount of sodium is taken up by the zeolite, thus restoring it to its original condition. The amount of salt solution is governed by a float switch. When the correct amount of salt has been fed into the softener, this float switch makes a contact, thus actuating the motor so that it rotates the valve to the rinse position.

In the rinse position, an electric time switch governs the rinse period, while a second butterfly valve regulates the rate of flow of the rinse water. The rinse serves to remove the excess salt and soluble by-products to the drain. At the end of the rinse period, the motor is again actuated so that it rotates the valve to the softening position, thus returning the softener unit to service. In the meantime, the meter has automatically been reset for the succeeding softening run.

In this way, all operations are automatically accomplished, both on the softening run and on the regeneration, which last term covers the backwashing, salting, and rinsing operations. The salt solution is formed in a large concrete wet salt storage basin, which has a capacity of two carloads of salt. From this, the saturated salt solution is automatically pumped into the brine measuring tank as required.

Therefore, about the only duty that devolves on the operator of an automatic water softening plant of this type is to see that the supply of salt in the wet salt storage basin is renewed when required. The operation of the Hollywood plant has been very satisfactory and the citizens are very well pleased with the quality of the softened water which it furnishes.

Frank C. Dickey, city manager of Hollywood, writes that the plant has been operating entirely automatically since it started in August, 1936. He has not had to put on any additional personnel in connection with the plant. The water is clear and soft. The consumption has increased to the point of crowding the capacity of the new plant and he is now contemplating adding another half million gallon per day unit.

This plant, due to the fact that the wells and service pumping station were of sufficient capacity, cost a little less than $50,000. A plant of this type, under normal conditions, of a capacity of from one and one-half to two million gallons per day, should cost from seventy to eighty thousand dollars.

This article is reprinted from the *Florida Municipal Record* through the courtesy of the Editor of that publication and of Mr. Smith.

A County Comes Out of the Mud

By MAURICE A. WEED

IT IS alleged that during a rainy season several years ago, a boat equipped with outboard motor was launched at the depot in Taft, Texas, and proceeded under its own power up the highway to Sinton, Texas —a distance of seven miles. The writer has been unable to secure unquestionable proof of the above incident, but engineers certainly have found farmers of San Patricio County "water conscious."

These citizens might also be described as "mud conscious," wherefor officials of the above county, with their engineers, have been able successfully to promote a county road improvement program which, when completed, will have cost a total of some $750,000, a portion of which is a grant from the Federal Government. The program, which it is expected to complete in the fall of 1937, includes permanent improvements on more than 100 miles of the county's farm-to-market roads, all but about 20 miles of which were unimproved or only partly graded.

Additional right-of-way is being acquired sufficient to give all scheduled roads a minimum width of 80 feet. New outfall channels and side ditches are being constructed and old ditches cleaned out, and the drainage generally improved; new, higher, wider roadbeds are being provided, and given a bituminous surface on a new base course.

The County Commissioners' Court made application to the Public Works Administration for a grant in July, 1935, but it was December, 1936, before the grant was finally made, subject to certain qualifications. One of these imposed time limits for contract lettings which would have defeated the program if the engineers had been less well organized. Also, without the hearty cooperation of R. P. Boyd and C. P. Smith, engineers of the U. S. Bureau of Public Roads, progress would have been greatly impeded. The last contracts were awarded June 4, 1937, and contruction work is progressing on more than 60 miles of the proposed projects, and the Public Works Administration has been asked for an extension of time on the remainder.

The most difficult engineering problem encountered was that of providing adequate drainage for the protection of both roads and property. It is said that when W. A. Bandy, chief engineer in charge of surveys, asked a Negro farm hand which way the water went after it reached a certain point, he replied: "It don't go nowhere from dat point, suh. When it git dare it's home!" Farmers and landowners stated that in some sections the water had been known to flow sometimes one way, sometimes another, depending chiefly, they believed, upon which direction the wind blew. In addition to the extreme flatness of the land, its non-absorptive nature, the lack of creeks and other natural outfall channels and the existence of numerous swales, all added complications to this phase of the work.

Much of the country's past effort in constructing artificial drainage channels had been made without sufficient engineering planning, and the fact that the program at hand was primarily one of road improvement restricted the engineers from devoting more than a minimum expenditure to problems of drainage not directly concerned with the protection of roads. In many instances, however, to avoid pooling water along the road, new outfall channels were included as a part of the program in some cases and in others additional right of way was acquired, side ditches were widened and material from the extra cut was used to form levees to prevent inundation of adjacent lands.

Investigation revealed that practically every existing drainage structure furnished insufficient clear waterway opening and was subject to washouts of the roadbed around each end, these structures having for the most part been built without plans or due consideration of conditions to be dealth with. New ditch grades and new drainage channels rendered many of the existing drainage structures unnecessary and their elimination was specified. This gave the farmers no end of concern, and in some few instances threats of injunction resulted, since they believed that adequate protection varied solely with the number of such structures.

Even with the elimination of all possible structures, there remained to be built some 170, including both culverts and bridge-size structures. It was deemed economically expedient to reduce the different types of structures to be used to the least number possible, and three main types have been utilized throughout the program. These are the WT-6, a pile-bent treated-timber trestle, which can be installed either as a single 15-foot

Above: Formboards in place on finished subgrade ready to receive base course material. Below: A treated timber pile bent bridge under construction. These provide a 19-ft. clear roadway

Above: Tractor and elevating grader "busting out" for subgrade after new ditches had been cut and roadbed raised and widened. Below: Caliche base course material being placed by means of 5½ yd. side-dump trailers

or 19-foot span, or as a multiple structure of any number of such spans; and the WBC-1 and WBC-2, single and multiple treated-timber culverts, which were designed especially for San Patricio County for use on the improvement program by the Southwest Engineering Co. of Texas.

Most used is the single-span structure, which offers from 10 to 130 sq. ft. of clear waterway opening in 54 different opening sizes with a 19, 23, 27 or 31-foot clear roadway. A crew of four men can easily build one of these structures in an eight-hour day. The multiple structure, slightly more complex in detail, was used in the few instances where a single structure was inadequate.

Only about six exceptions to these three treated-timber types occur in the entire program, these being reinforced concrete structures of standard state highway design, used where special conditions rendered the timber types impractical. In one such instance, where 60 sq. ft. of waterway opening was required under a super-elevated curve, a skewed, multiple concrete culvert was used, since it would have been impractical to place the necessary fill for super-elevation over a timber structure. The other exceptions occur under similar conditions, or where special drop-inlet structures were required.

The materials available made three types of base course practicable. These materials were beach shell (which has been used quiet extensively in this section), bay shore caliche and inland caliche. Some of the first contracts let provided for the use of each of these three materials, but later contracts were let exclusively upon the basis of the inland caliche. The bay shore caliche comes from pits bordering Nueces Bay, whence its name. It is ivory in color and is composed of fine particles of sand and calcareous dust with a clay content of about 17%. This material was used in a 4″ compacted depth covered with a 3″ compacted depth of the inland caliche on a 4-mile section of road. The Federal engineers, however, later condemned its use on any of the other roads.

Shell was used on one 13-mile section of road. It is a very satisfactory base course material but is particularly difficult to compact by rolling. Best results are obtained by opening the road upon which it has been placed to traffic for a period of several months, during which time the material must be constantly maintained to retain the desired surface. It has been found practical to make use of blockades to shift traffic from one part of the road to another to secure uniform compaction before any finished pavement is applied.

The U. S. Bureau of Public Roads, whose approval of all work is necessary, requested daily laboratory test reports on all inland caliche used as base material. In order to comply with this request, the engineers established a field testing laboratory in the chemistry room of the high school at Taft. Screen analyses and standard laboratory soil tests to determine the lower liquid limit, the lower plastic limit and the plasticity index were performed twice daily. Reports of these tests were furnished to the Bureau, supplemented from time to time by certified tests by the Southwestern Laboratories, thus giving adequate assurance that all materials placed conformed to specification requirements.

The specifications required that caliche base material consist of approximately equal proportions of calcareous dust, limestone and quartz sand, reasonably free of clay, and material passing the 40-mesh screen should have a lower liquid limit not exceeding 40 and a plasticity index of not more than 17. The bay shore caliche, which was condemned, besides containing 17 per cent clay, had a lower liquid limit of 55 and a plasticity index of more than 30.

When the program has been completed, some 200,000 cu. yds. of base course material will have been placed.

A pre-mixed asphalt surface or a double bituminous squirt-top surface would have been most desirable, but since the use of either of these would have made the cost exceed the available funds, an extra-heavy single bituminous surface is being used on all roads.

The caliche base course is brought to a smooth, uniform riding surface by means of grading and slush-rolling, and is then given a prime coat treatment of cut-back asphalt, and is opened to traffic for a time, after which all loose particles are removed with a rotary sweeper, and any faulty spots that have developed are repaired.

Following this, a compressor-distributor applies the hot asphalt at the rate of one-half gallon per square yard of surface, which is immediately covered with a one-to-fifty (one cu. yd. to 50 sq. yd. of surface) distribution of cover material, which is applied by means of mechanical spreader boxes attached to dump trucks. The whole is then subjected to drag-broom and rolling, and the thus-finished surface is ready for traffic. The cover materials used are crushed stone and pea gravel, with about half of the contracts let on the basis of each.

The decks of all timber drainage structures are level with the finished surface of the base course, and the hot asphalt and subsequent cover material are applied directly across these, giving additional protection from traffic and adding to their life.

Better Services From Standard Traffic Paint

Specifications for traffic paint and a machine for measuring the relative wear of such paints have been developed by the National Bureau of Standards during the past ten years. Distinct improvement in durability of traffic paints in actual service has resulted, according to the *Technical News Bulletin*. A circular describing the specifications and tests has been published by the Scientific Section, National Paint, Varnish and Lacquer Association, Inc., 2201 New York Avenue, N.W. Washington, D. C.

Mayor A. C. Metter

Pump house, Columbia, Illinois

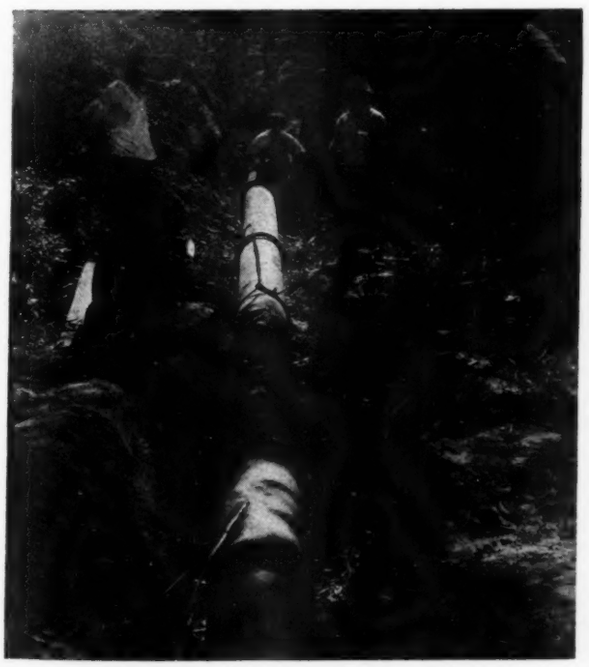
Geo. S. Russell

Solving Sewage Disposal with 4½ Miles of Cast-Iron Sewer Pipe

By GEO. S. RUSSELL

THE city of Columbia, Illinois, has just completed the construction of four and one-half miles of 12-inch sewer line built of cast iron pipe. This line carries the entire sewage of the city to an outlet in the Mississippi river. It is a good example of rather unusual conditions which could be met economically only by the use of cast iron pipe.

Originally Columbia discharged all of its sewage into an Imhoff tank located near the westerly city limits of the town. By 1934 the growth of the city had made the Imhoff tank inadequate and its location in the immediate vicinity of a newly developed residence district created a nuisance which aroused the citizens to such an extent that they petitioned the City Council to take some action to give them relief. In the spring of 1935 the firm of Russell & Axon, consulting engineers of St. Louis, were called in by the mayor, Albert C. Metter, to discuss means of remedying this condition.



12 inch cast iron pipe used for 4½ miles of sewer

Upon examination of the site it was obvious that the location of the existing disposal plant was too close to the residential property above mentioned to warrant the development of a modern disposal plant there. Investigations showed that the plant would have to be moved downstream at least a half-mile before a satisfactory location for a disposal plant could be found. The study also developed the fact that it would be more economical to build an outfall line to the Mississippi river about four miles away and to secure disposal by dilution. This would not only eliminate the first cost of building an entirely new sewage plant, but would also eliminate its maintenance and operation cost.

Locating the outlet at the point on the bank of the Mississippi nearest to the city would bring it at a portion of the river that was in danger of filling in with sand bars, but by building four and one-half miles of sewer an outlet could be located in a stretch of river bank about 1,000 feet in length that the Federal engineers considered as permanent in location.

Further study developed the fact that along this outfall location there was about one mile of bottom land subject to overflow at high water in the Mississippi, two miles of bottom land at about high water elevation of the river but protected by dikes, and about one-half mile of bottom land outside of this levee but subject to creek overflow. Also a profile of the line showed that, except in the very low stages of the river, the hydraulic grade line would be above the pipe if it be laid below the ground surface. Even at low stages of the river, because of the low grades in the overflow bottom, some of the pipe will probably act under pressure. To meet this condition, cast iron pipe with bell and spigot joints was selected as the material most suitable for meeting the engineering difficulties involved.

A pumping station consisting of two 300 g.p.m. Fairbanks, Morse pumps was installed at the upper end of the line. Although there is little indication that high water ever will reach such a level that there will be no flow by gravity, provision for pumping was still deemed necessary because of the fact that in such a long sewer laid on a very flat grade there would be a tendency toward the formation of deposits, and the operation of the pumps will eliminate this objection. The pumps are horizontal, direct-connected to electric motors, and installed in a dry well. They are float-con-

trolled and so designed that the pumps alternate under ordinary conditions of operation; but, if for any reason the hydraulic grade line continues to rise while one pump is operating, the second pump picks up the additional load.

An application for the financing of this project was submitted to the Public Works Administration in September, 1935.

In June, 1936, the project was turned down because of inability to market the securities offered. By September, 1936, however, the character of the securities offered had been changed and a grant agreement was submitted to the city by the P.W.A. In October, 1936, the detailed plans and specifications were completed and submitted to the P.W.A. for approval, and bids were received on the project on November 9, 1936. Dobson & Humphreys of Omaha, Nebraska, were the successful bidders, the amount of their bid being $59,500. The McWane Cast Iron Pipe Company furnished the pipe. Under the terms of the contract, construction work was to start November 30, 1936, and to be completed by May 1, 1937. Unprecedented rains, however, caused the shutdown of the project in January, 1937, for thirty days and further delayed this project, which was finally accepted June 28, 1937.

Causes of Tastes and Odors

TASTES and odors are no longer a cause for gray hairs among water works superintendents, according to a survey just made by the Editor of PUBLIC WORKS. Of some 750 cities, large and small, which were questioned, only about 10 percent admit to having tastes or odors in their water supplies; and almost all of these hastened to add that this condition applied only to the raw water, and not to the finished water. It is probable that many of these 750 cities that said they had no tastes and odors did have them in the raw water.

Modern methods of treatment are responsible for this improvement in water supplies. Mr. J. H. Beatty, superintendent of the Eaton, Ohio, water works, probably spoke for the majority of the cities when he said: "None; we use activated carbon on our filters." This statement was supplemented by Mr. H. J. Draves, acting superintendent of the Michigan City, Ind., plant, who said that a taste due to decaying organisms was removed with ammonia and activated carbon.

The following information is presented for the purpose of showing the predominating causes of tastes and odors in the various states:

State	*Trade Wastes*	*Algae*	*Leaves*	*Decaying Vegetation*	*Other Causes*
Alabama	..	1	2	2	..
Arizona	..	..	..	..	..
Arkansas	..	3	1	1	..
California	..	1	..	..	2
Connecticut	..	..	1	1	..
Florida	1	1	..	1	..
Georgia	..	1	1	2	..
Idaho	..	1	..	..	..
Illinois	..	6	2	1	..
Indiana	..	2	1	2	..
Iowa	..	4	1	4	2
Kansas	..	4	3	3	1
Kentucky	..	1	1	1	..
Massachusetts	..	7	1	2	2
Michigan	1	6	..	..	2
Minnesota	..	3	1	2	1
Mississippi	..	3	..	1	1
Missouri	..	2	2	2	..
Montana	..	2	1	2	..
Nebraska	..	2	1	..	..
New Hampshire	..	2	1	..	..
New Jersey	..	3	2	1	..
New York	2	9	4	7	..
No. Carolina	..	2	..	..	..
No. Dakota	..	..	..	..	..
Ohio	4	8	1	5	2
Oklahoma	..	2	1	..	..
Oregon	..	2	..	..	..
Pennsylvania	2	5	4	5	..
Rhode Island	..	1	2	1	..
So. Carolina	..	3	..	2	..
So. Dakota	..	1	..	1	..
Tennessee	..	2	..	..	1
Texas	..	1	..	..	..
Utah	..	..	..	..	1
Virginia	..	1	..	..	..
Washington	..	1	1	1	1
Wisconsin	..	1	1	2	1
Totals	10	96	36	52	17

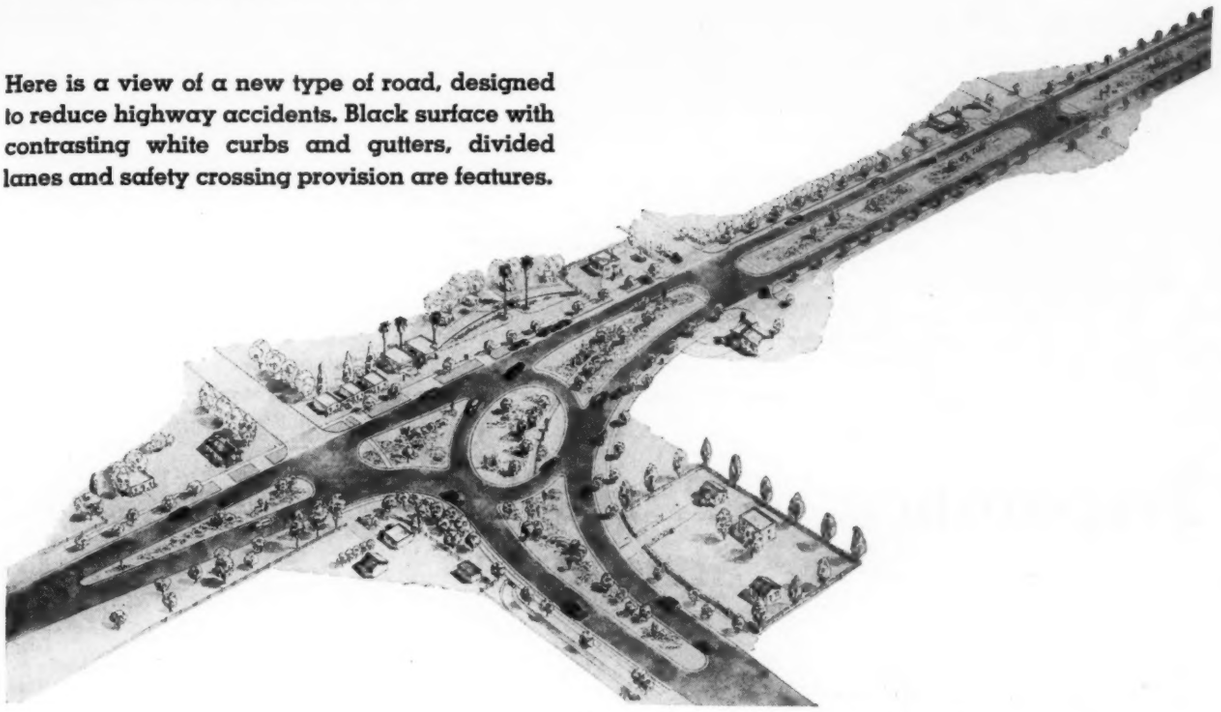
Since two or more causes may be present in one supply, the above total of 211 represents only about 100 cities and villages. Moreover, as already stated, this does not mean that taste and odor are present in the water delivered to the consumers. There are a few waters which occasionally develop tastes which ordinary methods do not seem to eliminate; but the problem will undoubtedly be solved in every case. In most cities, methods rapidly being standardized are fully effective. and there is no excuse for not utilizing them and very few cities fail to do so.

Repairing Water Service Pipes

The Ohio Court of Appeals holds, Seeley v. City of Norwalk, 53 Ohio App. 180, 4 N. E. (2d.) 403, that a city may be liable for damages resulting from leaks in service pipes of a municipal plant if, after notice, the city does not use reasonable care in correcting imperfections, even though such service pipes belong to the consumer, especially when the consumer is not permitted to make any corrections by repairing a leak or digging or excavating for it without the city's permission under its water department rules.

Group Served by Single Pipe Line Held One Consumer

A manufacturer by agreement with a water company received water through a single pipe for an industrial housing group connected with its plant, and distributed the water through its own pipes at its own expense. The Pennsylvania Superior Court held, Viscose Co. v. Public Service Commission (Lewistown-Reedsville Water Co., Intervener), 128 Pac. Super. 223, that the water company could not, without reasonable reimbursement to the manufacturer, fairly divide all the water used for all purposes in the section by the number of houses therein and bill the result as the average use of each building, family or establishment. The manufacturer was held entitled to have the section billed as one consumer. The court said the manufacturer could not have required the water company to make this agreement. The water company might have insisted on building its distribution system at its own cost and laying a separate service line to each consumer. It did not want to assume the cost and, instead, proposed the plan, which the manufacturer adopted.



Here is a view of a new type of road, designed to reduce highway accidents. Black surface with contrasting white curbs and gutters, divided lanes and safety crossing provision are features.

Arizona's "Fool-Proof" Road

WORK has been started on a thoroughfare which, although several similar ones have been built in the East, is believed to be the first of its type in the West. It will extend from Tucson, Arizona, for 1.75 miles toward the Florence-Casa Grande Junction on U. S. Highways 80 and 89. It will have two 22-ft. roadways divided by a central parkway 38 ft. wide with 5-inch curbs, which will allow emergency access to the center zone. Side streets will be continued across the parkway, the crossing affording a temporary stopping space between the two traffic crossings.

White concrete curbs and gutters on either side of the center strip, and a concrete parking strip adjacent to the property will contrast with the black surface of the highway and tend to guide drivers along the active traffic lanes. At the four corners of the cross streets, curb returns have a radius of 19 feet with a concrete transition section to join the gutter and parking strip, giving the effect of an indented parking lane.

At both ends of the project are right angle turns, that at the north end where State Highway 84 to Casa Grande joins U. S. Highways 80 and 89. To make these turns as safe as possible, traffic ovals were designed to regulate the flow of vehicles into separate channels.

Informal development of the separation islands will make of the highways a virtual parkway. Abundant cacti and other desert growth will be planted in the area, to diffuse headlight glare, simplify maintenance, and at the same time offer a unique planting area. Along the property line a sidewalk is proposed with a line of native Parkinsonia trees to be planted between the parking area and the sidewalk.

"Records show that a large percentage of the fatal accidents occur on straight, smooth sections of road and involve two or more vehicles in some form of collision and are caused by a car encroaching upon the wrong side of the highway," says H. H. Wessell, Arizona highway engineer. "Quite often these collisions occur at night or late in the afternoon as the sun is setting. It is natural to conclude that if highways can be built so that the driver is forced to keep his vehicle in its proper traffic lane, the contributing factors to head-on collisions will be practically eliminated. The divided highway, in its various forms, seems to be a possible solution for minimizing the causes of head-on collisions."

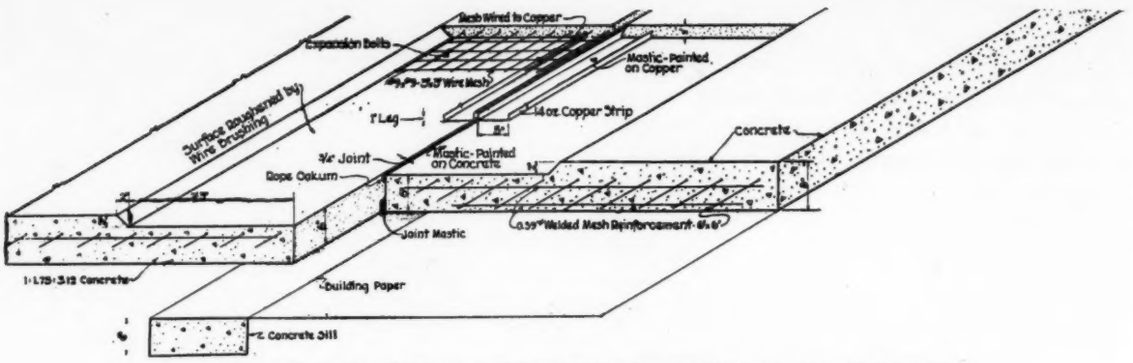
The particular safety feature represented by this "Miracle Mile" has proved completely satisfactory in Wilmington, Del., Philadelphia, and other eastern cities where traffic is much heavier than in Tucson.

Who first originated the idea of building such a project in Arizona is unknown, but to J. W. Angle, vice-chairman of the state highway commission, goes the credit of keeping after it until it was finally projected.

Mr. Angle worked in close cooperation with the mayor and city council, the board of supervisors of Pima county, the Chamber of Commerce, Realty Board, the Sunshine Club, other members of the highway commission, and the Federal Bureau of Public Roads, while property owners along the road gave active support.

The contract for building the road was awarded to the Tanner Construction Co. for $163,000. The additional cost of right-of-way, moving encroachments, etc., will bring the total to more than $200,000.

For the illustration and the above facts we are indebted to "Arizona Highways."



Isometric views, such as this of a reservoir lining, are helpful in showing details plainly

Preparation of Plans for Water Works Structures

"IT IS essential that both preliminary and final plans shall contain or be accompanied by sufficient information, design data, etc., to permit an intelligent consideration of the project. A detailed statement of all possible information needed cannot be included here. An example of data sometimes omitted will serve as a suggestion. The adequacy and quality of the proposed source must be known. . . . If wells are to be used, it should be stated whether existing wells have been tested, test wells have been drilled, or whether the quantity and quality of water is still problematical." — *Tennessee Dept. of Public Health.*

General procedure is recommended by Connecticut State Department of Health as follows:

1. Secure the assistance of an engineer experienced in the installation of water supplies. When the engineer has made preliminary investigations sufficient to indicate selection of available source, outline of system or type of purification, notify the State Department of Health before coming to any final decision, that it may make a preliminary examination of the proposed works. If the result of this is favorable, have complete detailed plans prepared, which should include:

   a. Map of municipality, showing topography and location of the source of supply.
   b. Plans showing detailed methods of obtaining, pumping, treating, storing and distributing the supply.
   c. If proposed water supply is of surface origin, a watershed map detailing reservoir development.
   d. If supply is of underground source, a map showing topography, water courses, roadways, drains, buildings and sewage disposal structures, within at least 500 feet of the proposed source of supply, together with details as to geological formations, observation wells and quantitative pumping tests.

2. Have the engineer submit data on blanks obtained from the State Department of Health explaining fully the selection of the proposed source and the basis of the design.

3. Have plans approved by council or board or by town meeting and submit application form signed by proper municipal officials; or in the case of privately owned waterworks, application to be signed by proper water company officials.

4. Submit to the State Department of Health:

   a. Complete detailed plans and specifications.
   b. Completed department data form and signed application.
   c. Report by engineer.
   d. Copy of council or town meeting action, if any.

The Kansas State Board of Health has an 8-page blank which when filled in constitutes an application and also provides detail information on the project. There are 30 items in this, and 71 subquestions. These include population data from 1900 to date; population supplied with water; detailed information on source of supply and its protection; purification methods and processes; and pumping and distribution. Large scale maps and general and detailed drawings are also required. The completed form, with attached data must be sworn to.

A Check List for a Water Treatment Plant

Preliminary:

Pipe line size; measuring incoming water; aeration.

Mixing Chamber:

Dimensions; capacity; retention; velocity; allowable loss of head; inlets and outlets; baffles or special mixing devices, as mechanical or air flocculators; covers.

Coagulation Basins:

Number; arrangement; dimensions; capacity; retention period; velocity of flow; inlets, outlets and overflows; sludge removal; water level regulators; elevations of water surface, maximum, minimum and average.

Coagulant Devices:

Location and arrangement; type of feed; solution tanks—number, dimensions, capacity; point of application of chemicals; dissolving, mixing and agitating devices; size and kind of piping; orifices; drains to solution tanks.

(Continued on next page)

Sizes and Scales of Drawings

Alabama requires all drawings to be not larger than 28 x 40 inches nor smaller than 8½ x 11 inches; folding is not permitted. Drawings should be bound on the left edge. Connecticut permits 8½ x 11, 22 x 30, 25 x 38 and, for profiles only, 22 x 70 inches. The standard 22 x 30-inch size is urged. North Carolina limits maximum size to 36 x 48 inches.

General maps should be drawn to a scale not greater than 100 ft. to the inch, nor less than 300 ft. to the inch. On large systems, several sheets will have to be provided, which should be indicated on a key or index map. Detail plans must be of such scale as to show clearly the various units and their method of operation. Free use should be made of elevation data.

Titles should show name of municipal-

A Check List—

(Continued from preceding page)

Filter Units:

Type, material and number of units; areas and capacities of each; dimensions; wash troughs, number, material and shape; distance above sand; travel of suspended particles; kind, depth, effective size and uniformity coefficient of sand; gravel size, number of layers and depth; filter bottom type; manifold size; number, spacing and size of laterals; number, size, spacing and position of strainer openings; strainer type, position, number, total cross-sectional area of openings; ratio of sand area to strainer opening area, of strainer openings to strainer neck openings, of strainer neck openings to lateral openings, and lateral openings to manifold cross-sectional area; depth of water on sand; type and rate of wash; loss of head gauges, type and location; rate controllers; rate of flow gauges; sampling devices; wash water head available; facilities for supplying wash water, as pumps or tank; of tank, location, size, head available; wash water disposal.

Pipe Gallery:

Arrangement, location and dimensions of pipe gallery; sizes of pipes; velocity of water; raw, main influent, branch influent, main and branch effluent, main and branch wash water; main and branch sewer; rewash; valve controls; drainage.

Clear Well:

Location and arrangement; dimensions; capacity; retention; cover; manholes; vents; suction or discharge pipe location; water level indicator.

Pumps:

Number; type; capacity; head designed for; power; location; housing.

Disinfection:

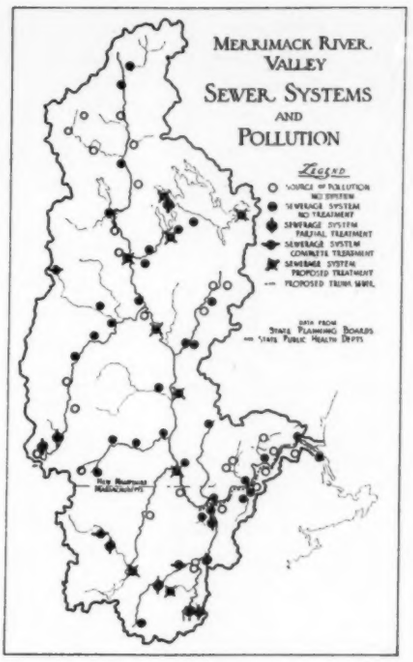
Chemical employed; type of apparatus; point of application; control of dosage; scales; meters.

Laboratory:

Space; equipment; tests to be made.

Other Devices:

Weirs; meters; measuring and control devices; remote and automatic controls; by-passes.



A map like this shows sources of possible contamination

ity, locality, general title of plans, specific title of sheet, date, scale, name of engineer and, when there is more than one sheet, the number of the sheet and the total number of sheets. This is preferably placed in the lower right corner.

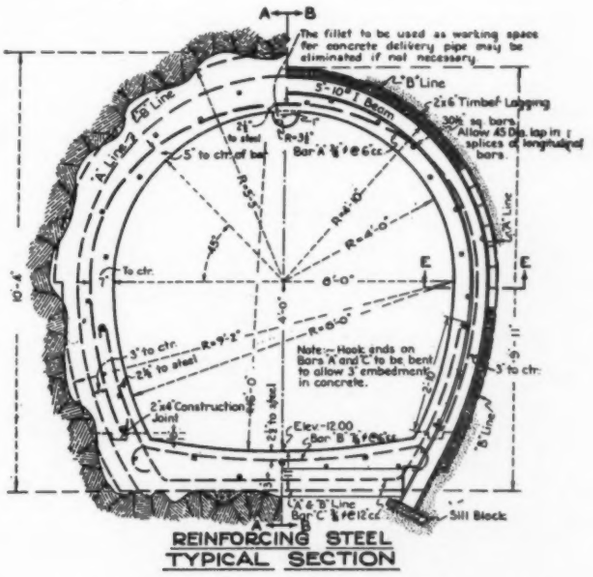
Plans for Supply and Distribution

The general map (scale 100 to 300 ft. to the inch) should show the entire area of the district to be supplied with water; this map may be subdivided if the area is too great to be shown on one standard-size sheet. This map "should show all existing or proposed streets and the elevations of the principal parts of the water system, such as the water surface at the intake, in the reservoir, or standpipe, etc. The location of all intakes, valves, hydrants, reservoirs, pumps, standpipes and purification works, and of any special structures shall be shown. . . The location of (proposed) emergency supplies shall be shown. The sizes of pipes shall be lettered between street lines and along the pipes. The map shall show . . . the municipal or district boundaries, and the low, mean and high water elevations at the intake. If the site of the pumping station is subject to flooding the elevation of the highest known water level shall be shown. Lettering, lines and symbols shall be distinctly shown. Pipe lines to be built at present shall be shown by solid lines, and future construction by broken lines. Topographic symbols of the U. S. G. S. shall be used." — *Alabama State Board of Health.*

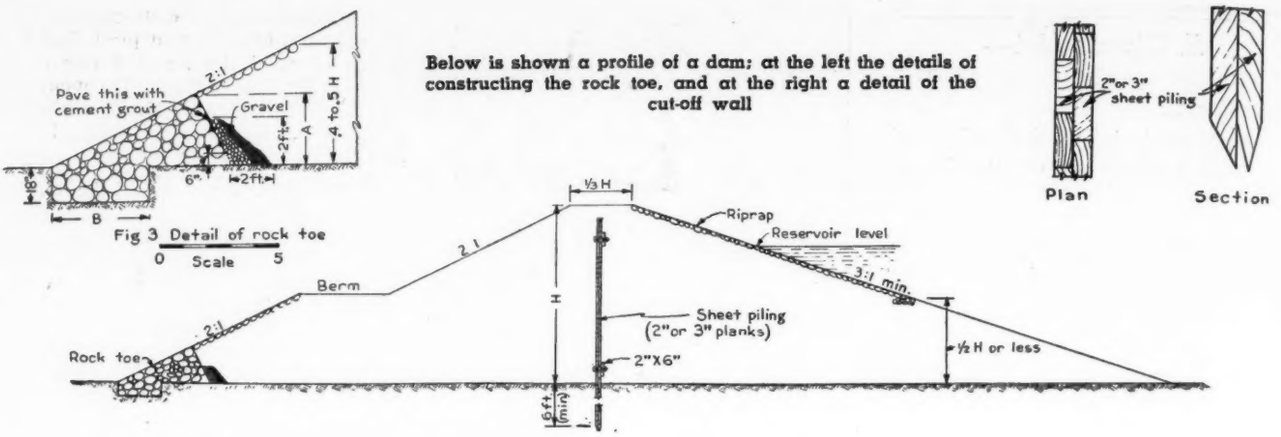
In addition, there should be detail drawings of all special appurtenances, as blow-offs, siphons, conduits, reservoirs, elevated tanks and standpipes. A small scale map should be prepared of the watershed and reservoir area, showing sewage plants or lines, industrial plants discharging wastes, roads, camps, houses, etc. When springs, wells or collecting galleries are to furnish the supply, all structures, streams, roads, etc., within 500 feet of the source should be shown; and also details of the collecting galleries, spring protection devices, or well construction.

Plans for Purification Plants

Detail plans of purification plants must show the arrangement, size and construction of sedimentation basins, mixing chambers, baffles, inlets and outlets, special arrangements for feeding chemicals, blow-offs or clean-outs, elevation of each unit, etc. If filters are contemplated, complete plans of lay-out and detail, showing coagulating devices, sterilization devices, devices for measuring and reading loss of head, rate of filtration, apparatus for collecting water, apparatus for washing, arrangement of beds, of pipe gallery, sand and gravel, of pumps, etc., and any other special appurtenances. Filter company's plans must accompany the plans, also; and working drawings must be submitted during construction, if any change is made from the original design. A general lay-out plan must also accompany the plans, showing various units of the process, with reserve areas for future extensions. — *Kansas State Board of Health.*



Essential details of a tunnel section



Below is shown a profile of a dam; at the left the details of constructing the rock toe, and at the right a detail of the cut-off wall

Pumping Plants

The details of construction of pumping pits or pump rooms should be shown, with elevations. Methods of connections to wells are important to prevent contamination. Provision for drainage of pump rooms must be provided. Various of the important details regarding pump installation, well covers and casings are described in detail by the Minnesota State Board of Health.

Types and location of pumps must be shown, with number, capacity and kind of power. The type of controls should be shown in detail. Full specifications on the pumps should generally be filed with the engineers' reports.

Engineer's Report

The report should be submitted on letter-size sheets, typed, double-spaced, and bound together. This report, with the plans and specifications should serve to give a complete picture of the proposed work.

The report should show the present population to be served and the estimated population for 10 to 25 years. The computations whereby this future population is arrived at should generally be shown. Similar data on per capita and total consumption should be provided.

The Alabama State Board of Health gives the following outline of desired information to be furnished in the engineer's report:

The Source of Supply. If from a surface source, the results of the chemical and bacteriological examinations of raw water shall be included. The area, population, and description of the watershed shall be given, the sources of pollution, including publicly and privately owned sewage treatment plants discharging effluents into the source of supply and plants discharging industrial wastes, and protective measures to be installed or enforced for the protection of the supply, such as patrol, fishing, and bathing regulations, etc. If from an underground source, information shall be given on the various strata and based on the results of analysis, or other available information regarding water from similar sources, the probable quantity and quality of the supply.

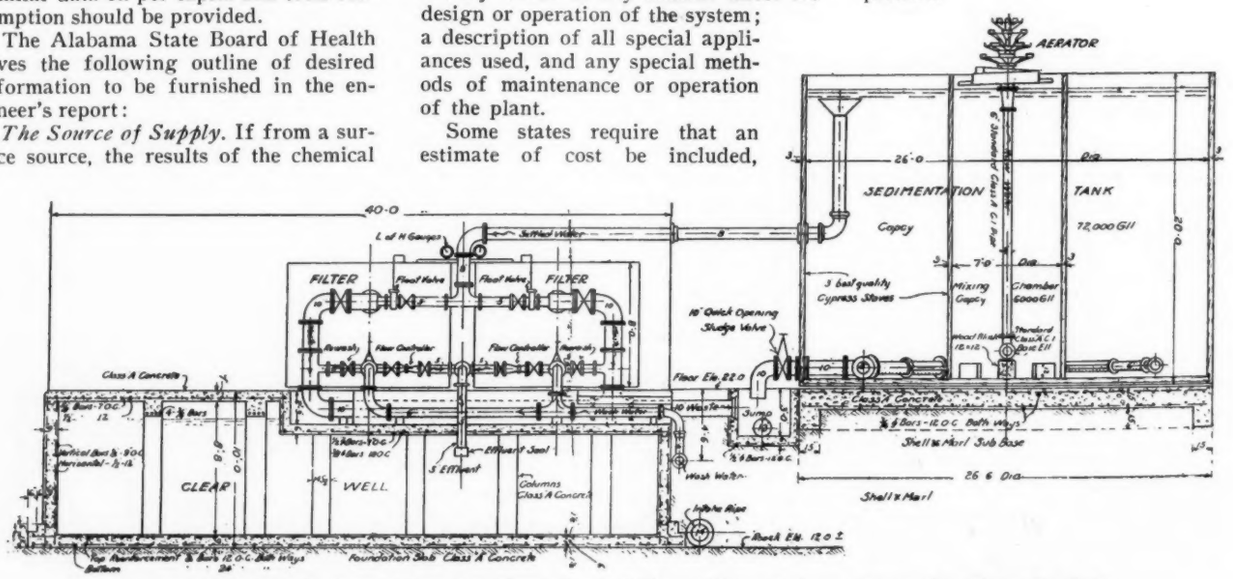
Description of Pumping Equipment. A description shall be given of the pumping equipment, the methods of connecting pumps with well, suction lines, etc.

Purification. The method of purification and a description of the units of the system must be given together with the rate of operation of each unit of the system; if chemicals are to be applied the nature and quantity to be used of each, with a description of the appliances for adding the same to the water. A description should be given of all conditions peculiarly characteristic of the water or locality which in any manner affect the design or operation of the system; a description of all special appliances used, and any special methods of maintenance or operation of the plant.

Some states require that an estimate of cost be included, others do not. It is generally desirable to do this in order to provide the maximum information to the state to aid in proper judging of the project.

Specifications

Requirements regarding specifications vary. It is not usually the case that construction specifications are furnished with the plans. To do so would, in cases where the state requires some changes, involve much added work. It is usually sufficient to outline general specifications for the work. For instance, concrete specifications for purification plant structures; material specification for earth dams: the class of cast iron pipe to be used; and similar data. On the other hand, where manufactured products are to be used, specifications are more often furnished. These items might include chlorinator capacity requirements; pump specifications; filter sand and filter appurtenances; flocculators; aerators; etc. The regulations of each state should be ascertained in advance. It is good practice to work with the state from the beginning. Once an engineer has been appointed, the state will usually cooperate fully and often can furnish much data that otherwise requires time and effort to procure.



This section through clear well and sedimentation tank shows design features of a small water works plant

The Editor's Page

Sterilizing Wells and Other Water Supply Elements

One of the useful services rendered by most State health boards is the analyzing of water supplies, private as well as public, chiefly to determine their safety. An engineer of such a board tells of one citizen who sent several samples from his well, which always showed gas-forming bacteria, and who, protesting he had taken every precaution against pollution, asked for a visit by the engineer to determine the trouble. And the engineer, finding no visible cause, from the wisdom of his experience pulled up the pump rod and found on the leathers a flourishing colony of the offending bacteria, probably there when the pump was installed.

Such sources of pollution are not confined to small private supplies. The State Board of Health of South Dakota calls attention to the possibility of introducing pollution to public supplies when installing or repairing wells, pumps, tanks, mains, etc. and has issued instructions for avoiding this—packing valves and new leathers should be kept clean and soaked in a strong chlorine solution before placing in the well; drop rods, if removed, should be kept elevated above the ground and away from contaminating sources; and before the well is put back in commission it should be sterilized by pouring a strong chlorine solution inside the casing.

It is easy to overlook the necessity for these precautions; but it is criminal for a water works superintendent to do so.

In Time of Heat, Prepare for Snow

It takes somewhat a stretch of the editorial imagination to think of snow removal, snow fences and ice control, during the August heat that has been so oppressive. It is probably just as difficult for the maintenance engineer of the state highway department, the county engineer, the city engineer or street superintendent and the township supervisor to plan for this winter's snow fighting while he is mopping at the perspiration that rolls off his brow.

Yet each year this becomes more necessary, because this country is a nation on wheels—mostly on rubber-tired wheels. Forty years ago, the hardy individualist set forth with a team of horses attached to a bobsled, armed with a shovel. Today that is not possible. It is a community problem to keep the streets of our cities and the highways serving the rural population free from snow and safe for travel. Food supplies, for the most part, are not stored in bulk at the point of consumption, but must be moved without delay to feed the people. In the days of the hardy individualist afore-mentioned, a barrel of salt pork, a tub of sausage, a barrel of flour and a few sacks of sugar—plus a cellar filled with apples, potatoes, pumpkins, etc.—kept the wolf from the door. Today, that same cellar contains a dozen cans of vegetables, one of salmon, 5 pounds of potatoes and a few other odds and ends of food. The 6-cubic foot ice box is the family larder—and it doesn't take long to make it look mighty skimpy.

Business loses money when snow blocks the roads; and when the roads are open, the gasoline tax that would otherwise be lost is more than sufficient to pay costs of snow fighting. It pays to keep the roads clear, in cash money, in comfort, and in health protection. And to keep them clear requires modern equipment and good organization. Beginning next month, we'll cover this subject in some detail.

Paint, Elbow Grease and Good Housekeeping

In talking to a group of operators of water plants, George W. Biggs, Jr., of the American Water Works and Electric Co., Inc., stressed the necessity of keeping water plants not only in good operating condition, but also fine appearing and well-maintained. For years, he said, he has stressed the value of paint and brass polish in pumping stations; and for the individual in the front office, soap and water and a clean shirt are just as necessary. He also emphasized the necessity for courtesy in personal contact and over the telephone.

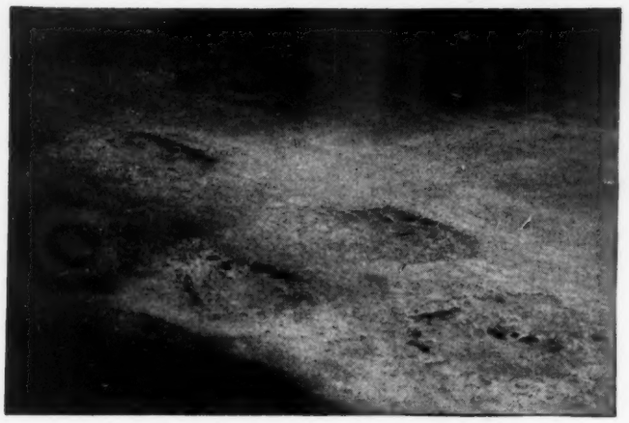
What Mr. Biggs said referred to private water works plants especially, but it is just as true of every other phase of engineering, or of operation. The sewage treatment plant brings fewer complaints if landscaping and proper upkeep make it look attractive; grass and flowers contribute to overcome the popular notion that a sewage treatment plant is, *per se*, a nuisance. Well kept highways, with weeds and brush neatly mowed, slopes planted with shrubs or flowers (local varieties are cheap and most effective) and guard rails and bridges properly maintained, are attractive, and a good insurance against complaints.

A Fish Story

Two trout and several flocks of minnows have made their home in the final settling tank of the Ridgewood, N. J., sewage treatment plant. This tank is very near the level of the Hohokus Brook, into which the effluent is discharged, and entrance and exit on the part of the fish is not a difficult matter. The fish have been living in the tank for some weeks now, and seem very much at home there.

It is gratifying that the art and science of sewage treatment has progressed to such a stage that it not only can avoid damage to fish life but even goes a step further and provides a refuge for the fish. The effluent that the fish find so agreeable results from chemical coagulation, followed during a portion of the time by trickling filters; but even when the trickling filters are not in operation, the effluent from the tank in which the coagulated sewage is settled appears to meet all the piscatorial needs for a home.

Village Engineer R. A. Hartom and Operating Engineer John W. Hood have been the subject of considerable pleasantry on the part of North Jersey engineers and officials over their so-called "fish farm." They are to be congratulated in operating the plant so effectively as to eliminate any chance for complaint, even on the part of the fish.



Above, A. Showing Pot Holes before patching

Right, B. Filling the holes

Patching Pot Holes

IN patching potholes, there are two reasons for using a hand spraying attachment on a heating kettle: 1. Pressure. 2. Speed. If bitumen could be applied with a pouring pot with as much pressure as exists in the spray from the nozzle of the attachment, it would be possible to do just as good work with the pot as with a sprayer. Also, if the amount of work to be done was small and there was ample time to do it—if good labor were dirt cheap and plentiful—then there would be no economy in using a sprayer. But you can't get pressure in the sprinkle from a pouring pot and you can't speed up the work.

The pot holes in Picture A are about 18 in. long, 12 in. wide and 4 in. deep. To patch them properly, the first step is to clean out the hole and sweep out all dust, moisture and loose particles.

Next, with the sprayer and the proper bituminous material, spray the inside of the pot hole thoroughly. This is the prime coat. Picture B shows this prime coat being applied. It closes the sides of the hole and the bottom against water seepage. It also assures the patch of adhering to the parent material in the road.

Third, fill the hole with small, dry, clean stone. Do this in two or three stages, depending on the depth of the hole, spraying each stage thoroughly to be certain all the particles are thoroughly coated. Picture C shows this stage in the work. The pressure of the spray will penetrate two inches or so of stone, depending on the size. If you were using a pouring pot, you would have to depend on gravity and hope for a fair amount of penetration. The spray assures even, deep penetration and proper coverage. If hot material is being used, you'll get a uniform temperature in the patch that would be impossible if you had to do the job by the slow pouring pot method.

Fourth, when the hole is level full, give it the last seal coat spraying, then scatter a few more chips over it, tamp it thoroughly until the top is level with the road. This last sprayed coat seals over the top of the patch and also seals the edges, where these join the surface of the existant road, against breaking loose or raveling—also against seepage. The few pebbles scattered over the top prevent passing traffic from picking up the soft or unhealed bitumen; they give it a chance to set up without injury.

Here again the pressure spray is valuable. It enables you to put down a uniform seal coat that penetrates without causing some fatty spots and other lean parts. It *can* be done right with a pouring pot, but it takes time.

Furthermore, a spray attachment enables you to dress stretches of shoulders, fill cracks, paint-coat large areas for sheet asphalt repairs—in short, you can do with one spraying attachment as much work as would require a couple of dozen men with pouring pots—and generally do it better.

The motor driven sprayer is faster and requires less labor to operate than the hand driven type. Both produce the correct amount of bitumen at the nozzle to suit the working speed of the average man. A cock in the spray bar quickly adjusts the flow to suit conditions on the job. Nozzles giving conical or flat spray can be used to give the type of spray suited to the job. Rubber hose, good for applications up to 250 degrees F., or flexible metallic hose can be obtained.

Adapted with slight changes from the Littleford "Elbee Tatler," for August, 1937.

Applying Seal Coat and Brooming last chips smooth

The water used by Edgemont, S. D., comes from the wells at a temperature of 127°F—too hot to use for bath water in summer. The temperature is reduced by storage in two reservoirs having a combined capacity of 500,000 gallons.

Heat Treatment of Sewage Sludge

HEATING sludge aids in dewatering it, and a process for applying heat for this purpose has been tried out at Halifax, England; the results being reported by C. Lumb, manager, and J. Hirst, chief technical assistant, Halifax Corporation Sewage Dept., in a paper before the Annual Conference of the Institute of Sewage Purification. A brief abstract of that paper follows.

The sludge treated was a mixture of humus from secondary sedimentation of percolating filter effluent and of excess activated sludge. The heat was applied by means of steam under pressure, optimum results being obtained with steam of 184°C. at 150 lb. pressure applied for 30 min. Heat conservation is effected by utilizing the waste heat from hot treated sludge to heat the cold raw sludge in tubular heat interchangers; 80% of the heat being reclaimed by employing a counter-current system.

Sludge so treated was allowed to stand for several hours, the supernatant liquid decanted, and the sludge forced by compressed air at 100 lb. pressure into a filter press using cotton twill cloths, where cakes from ½" to 1½" thick were produced. Part of the steam used for heating was condensed and combined with the supernatant.

The results clearly indicated advantage in using steam at temperatures corresponding to high pressure; also that duration of heat treatment had little effect on quantity of liquor liberated from the sludge, but considerably reduced the time necessary for pressing the cakes. However, as 60 minutes heating reduces the pressing time only 30% under that required by 30 minutes heating, the latter was considered more economical.

The pressed cakes were of good hard quality, with only a slight odor and that devoid of any sewage taint; much drier than those from chemically treated sludge and less in weight because containing no chemicals. The time to press a cake from heat-treated sludge varies directly as the thickness of the cake, but with chemically treated sludge the time varies roughly as the square of the thickness. Also the former continue to lose water rapidly if removed to a dump, drying down to 25% moisture in one to three weeks.

When treating primary sludge or activated sludge alone, or a mixture of these by the above method, it was in all cases "remarkably efficient in destroying the colloidal nature" of the sludge; the best results being obtained with activated sludge alone.

One objectionable feature is that the heat treatment causes a considerable quantity of solid matter to go into solution and the decanted liquor was greenish in color and comparatively highly charged with dissolved nitrogenous organic matter. The proportion of solid matter dissolved appears to be independent of the intensity or duration of the heat treatment, and such dissolved matter appears to be organic only. No fatty matter is dissolved and wherefore it constitutes a larger percentage of the solids than in the unheated sludge.

Because of the strong decantrate, means would need to be provided for purifying or disposing of it as well as the press filtrate. The loss of a large proportion of the nitrogen content would affect unfavorably the use of the cake for fertilizer; but on the other hand, the reduction of solid matter would correspondingly reduce the quantity of pressed cake to be formed and disposed of.

Experiments in disposing of this strong liquor were not very satisfactory. When turned back into the crude sewage, it "had a definitely deleterious effect on the quality of the final effluent produced, as judged either by the oxygen absorbed from permanganate or by dissolved oxygen absorption tests," whether treatment was by trickling filter or activated sludge; although the former gave a more highly nitrified effluent than the latter. Trial was then made of chemical precipitation, using sulphuric acid, alumino-ferric, lime, and ferric sulphate, but with little success. Even double filtration of diluted liquor failed to give an effluent meeting the standard of the Royal Commission. Then trial was made of diluting the liquor to 20% with humus tank final effluent and feeding this to a filter at a rate of 50 gpd per cubic yard, and returning the effluent of this to the crude sewage which was then either filtered or treated by activated sludge. This still gave increased values, in the final effluent, for the permanganate oxygen absorption tests but only negligible increase in the five-day B.O.D. figures. This treatment therefore was deemed to be satisfactory.

Summary and Conclusions

Summing up, the authors drew the following conclusions:

"1. Heat treatment of all the types of sludge examined destroys the colloidal properties and reduces the hydration of the solids, so that the bulk of the water may be separated by settlement and the thickened sludge remaining easily and rapidly dewatered by mechanical means.

"2. Filter-press cakes may thus be obtained in much shorter time, and in much drier condition, than could be readily attained by other methods. Particularly does this apply to secondary sludges, which are but indifferently amenable to dewatering by other means.

"3. In the case of mixed humus and activated sludge, best results, consistent with economy of operation and installation, are obtained by heating for thirty minutes at a pressure of 150 lb. per sq. in.

"4. The heat treatment results in the solution of a portion of the solid matter and of the bulk of the organic nitrogen content of the sludge. The substances dissolved, which are nitrogenous in character, pass into the decantrate and press filtrate. The amounts so dissolved are proportionately greater with sludges rich in nitrogen, the fraction being thus greatest in the case of activated sludge and least in the case of primary sludge.

"5. On a working scale, means may consequently need to be provided for purification of the liquors, other

than by merely returning them to the sewage flow. This, however, would naturally depend on the nature and quantity of liquor produced in relation to sewage, and on the strength of the sewage treated.

"6. In the case of liquors derived from secondary sludges, satisfactory effluents cannot be economically produced by single or double treatment of the diluted liquor, either by bio-filtration or activated sludge treatment.

"7. Single filtration of the diluted liquors, followed by return to the sewage flow, results in only a negligible increment in the B.O.D. of the final effluents from bio-filtration or activated sludge methods of purification.

"This procedure may accordingly offer a means of disposal."

Location of Garbage Disposal Plants

The Michigan Supreme Court holds, Jones v. City of Detroit, 277 Mich. 272, 269 N. W. 171, that the state statute of 1927 preventing one municipal or public corporation from establishing garbage disposal or reduction plants within the corporate limits of another municipality without permit authorized by a vote of the qualified electors, and declaring a plant so erected a nuisance, is not repealed by the act of 1933 authorizing the acquisition or construction of such plants by municipalities, the later act concerning self-liquidating projects. The two acts, reasonably construed, serve together.

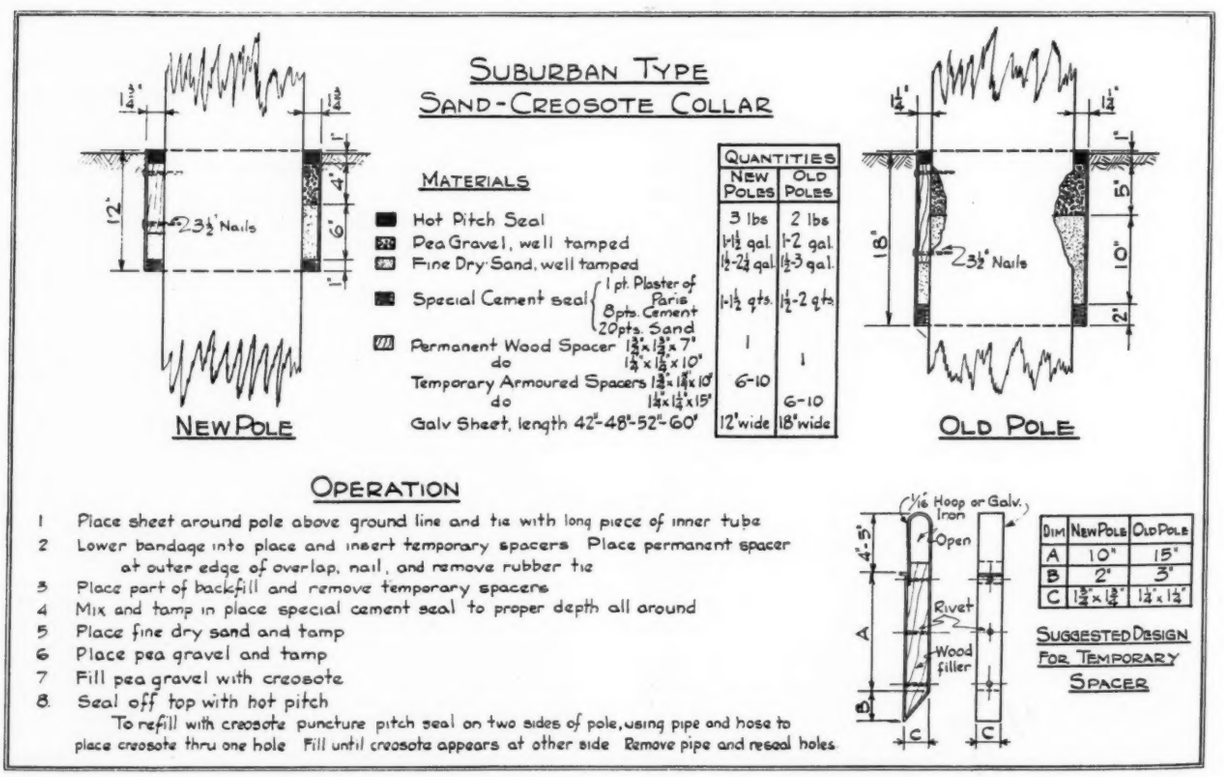
Ground Line Preservation of Poles and Posts

The strength of a pole or post is largely determined by the amount of sound wood at or just below the ground surface. Rot begins at the ground line and progresses downward a foot or so, and inward. A means of treatment with creosote has been devised by the Hydro-Electric Power Commission of Ontario which is adaptable to poles and posts generally. This consists essentially of the application of a creosote bandage of sand and gravel, and is adaptable either to new or to old posts.

The creosote will diffuse into the surrounding earth rather than into the wood unless a container is used. For the container, 28 gauge galvanized sheets, grade B, ASTM Spec. A93-27 with a minimum zinc coating of 1.8 oz. per sq. ft. are most satisfactory. Most poles are 30 to 50 ins. in circumference, and sheets 36 ins. wide by 84, 96, 108 or 120 ins. long are most economical. These can be cut into 4 or 6 "bandages" as required by the size of the pole.

On standing poles or posts, the earth is excavated for a width of 9 inches around the butt and to the depth of the rot. All of the rot is cleaned off. The hole is then backfilled and tamped to within 18 inches of the ground line. The sheet is wrapped around the pole at any convenient height, drawn up by a wire to an average distance of one inch from the surface of the pole, and then lowered into the hole. It is then wedged in place and backfilled to a depth of 4 ins., the backfill being outside the bandage and tamped to hold it in place.

Two or three methods have been developed, one of the most practical being that shown in the accompanying illustration. This employs a rubber band for holding the galvanized sheet or bandage temporarily, it afterward being nailed to wedges or spacers.



Details and directions for treating posts and poles with preservative

Effect of Highway Design On Vehicle Speed and Fuel Consumption*

A PUBLICATION reporting experiments performed to measure the effect of highway design on vehicle speed and fuel consumption has recently been issued by the Oregon State Highway Commission as Highway Department Technical Bulletin No. 5. The report was prepared under the supervision of Mr. John Beakey, Traffic Engineer.

The primary purpose of the investigation was to determine the effect of grades on fuel requirements. However, before actual tests could be made it was found necessary to broaden the scope of the work to include tests on curvature and surface types in order to eliminate, as much as possible, those variables.

Since motor fuel consumption makes up a large part of the total vehicle operating cost, the importance of better understanding of factors affecting this variable is apparent. Among these factors, speed and gradient are by far the most important.

The report presents the results of tests made over a period of a year and a half on passenger cars and heavier equipment operating under both controlled and actual operating conditions. Only a limited number of vehicles were tested, but the results serve to point the way toward a more accurate analysis of the effect of highway design on vehicular operating costs.

The conclusions reached in this study are as follows:

A. Relative to Level Road-Grade Equivalents

1. The potential energy theory heretofore applied to grade reduction problems fails to furnish a true method for the determination of level road equivalents since in that method no consideration is given to the dissipation of stored energy when descending grades.

2. The true measure of level road rise equivalents must take into consideration both up and down grade operation, and should be based upon total operating costs rather than upon fuel costs alone. When these factors are duly considered, the results of these tests indicate the following general relationships for motor-vehicle equipment in current use.

(*a*) For modern passenger cars the level road equivalent of 1 foot of rise varies from 2.28 feet to a value less than 1 foot and is therefore, in general, negligible in grade reduction problems.

(*b*) For heavier equipment the level road equivalents are considerably larger, and, in general, increase with the percent of grade largely because of the necessity for shifting gears on grades, a necessity which does not exist in the case of passenger cars for the grades investigated. As an example, with a truck weighing 45,000 pounds gross the level road equivalents determined by these tests were as follows:

Percent of grade:	*Level road equivalent of 1 foot of rise (feet)*
1 percent	2.20
2 percent	4.45
3 percent	6.65
4 percent	8.90
5 percent	12.00
6 percent	15.20

(*c*) In general, the level road rise equivalents for automotive vehicles in any weight class can be determined from the formulas and curves given in the body of this report, once the fuel consumption on grades and on the level are known. These fuel consumption values, for heavy equipment, may be estimated very closely from the following formulas which are based upon the results of this investigation:

For level grade.....$C=0.0001283W^{0.712}$
For 1 percent grade.....$C=0.0001179W^{0.723}$
For 2 percent grade.....$C=0.0000954W^{0.750}$
For 3 percent grade.....$C=0.0000731W^{0.785}$
For 4 percent grade.....$C=0.0000542W^{0.825}$
For 5 percent grade.....$C=0.0000373W^{0.876}$
For 6 percent grade.....$C=0.0000260W^{0.928}$

Wherein "C" is the consumption of fuel in gallons per mile, and "W" is the gross weight of the vehicle in pounds.

3. The above level road equivalents take into consideration both ascending and descending grade movements. In those rather unusual cases where it becomes necessary to consider the level road equivalent of 1 foot of rise for ascending grade movement only, the tables and formulas given in the body of this report furnish a basis for the determination of such equivalents.

B. Relative to Fuel Consumption (Light Vehicles)

4. For the average modern passenger car, fuel consumption at constant speed on ascending grades up to 6 percent increases at a uniform rate with each percent increase in grade.

5. For the average modern passenger car, fuel consumption at constant speed on descending grades up to 6 per cent is, at the lower speeds, a time function depending upon the idling adjustment of the given vehicle. At all speeds at which throttle opening is required, fuel consumption decreases at a nearly uniform rate with each percent increase in descending grade.

6. For the average passenger car, fuel consumption at constant speed for composite grades (i. e., both ascending and descending) increases with each percent increase in grade, the rate of increase being somewhat greater for the steeper grades. The increase in fuel consumption for this class of vehicle, however, is generally so small as to be negligible unless traffic is abnormally dense, and for this reason grade reductions below 6 percent can generally be justified only when there is or will be a considerable volume of heavy truck traffic.

C. Relative to Fuel Consumption (Heavy Vehicles)

7. For heavy automotive equipment, fuel consumption is definitely a function of the percent or rate of grade because of the characteristic speed and gear employed on each grade.

8. Descending grade fuel consumption for heavy vehicles varies between wide limits due to the effect on speed of grade, length, curvature and weather conditions.

9. In general, fuel consumption for heavy equipment increases with each percent increase in grade; however, no material saving is possible through the reduction of grades of 2 percent or less. This is true of gasoline powered trucks, and results from a limited number of Diesel powered trucks indicate that savings from grade reductions will be proportionally the same.

10. In general, fuel requirements on a section comprising several different grades will be the same (except for the effect of vertical curves, which is small) as that on the same length of constant grade of the same

* From "Public Roads," journal of the U. S. Bureau of Public Roads.

average rate, provided that conditions of constant speed and uniform fuel mixture are maintained.

11. The time savings obtained from grade reduction in the case of grades up to 6 per cent is of no material importance to light passenger vehicles but does affect truck operation on grades steeper than 2 percent. The relation between speed and gross weight for the six heavy vehicles included in these tests operating on grades may be expressed as follows.

For ascending grades:
Speed (m.p.h.)=60—0.5 W—4.33G.
For composite grades (ascending and descending):
Speed (m.p.h.)=60—0.5W—1.5G.
Where
W=The gross weight of the vehicle in thousands of pounds.
G=The percent of grade.

D. Relative to Road Design

12. Power requirements and consequent fuel consumption for light vehicles will not be materially affected by road curvature of 6° or less if such curvature is properly superelevated. No tests were made on spiral curves such as are now standard for trunk highways in Oregon.

13. The difference in efficiency between a concrete road surface and a modern bituminous type is very slight when considered from a fuel consumption standpoint.

14. The above conclusions have dealt with conditions wherein the effective rise and fall has been decreased. Grade reductions in which the effective rise and fall is not decreased will result in no material savings in fuel consumption for light passenger cars, but will effect some saving in the case of heavy automotive units.

E. Relative to Diesel Powered Trucks

15. Results from a survey comprising 100 vehicles in actual service show Diesel fuel consumption, expressed in gallons per mile, to be 40 percent less than gasoline in relatively level country and 45 percent less in mountainous country.

16. Reduction of those grades that will result in savings of fuel on both heavy and light equipment will yield greater fuel savings, on a ton-mile basis, with heavy than with light equipment. However, the resulting savings in cost of operation per ton-mile may be less on Diesel powered heavy equipment than on passenger cars due to the lower cost of fuel.

F. Relative to Automotive Equipment in General

17. Passenger car operating costs are materially affected by carburetor and timing adjustments.

18. Fuel requirements even for a limited number of vehicles will show a wide variation depending upon individual characteristics.

19. Gasoline consumption will generally vary directly as power output over a considerable range, but air-fuel ratio may materially affect the linearity.

20. Any drop in air-fuel ratio, particularly noticeable at high and at low power requirements at constant speed, materially increases fuel consumption.

21. The exhaust gas analyzer used in these tests proved indispensable for duplication of results and for confirmation on the accuracy of the results of gasoline consumption tests on light vehicles.

22. The overall thermal efficiency of the average passenger car increased with an increase in engine load produced, either by an increase in speed or by operation on steep grades, or both. The peak efficiency was attained at a relatively high speed on a steep grade. Engine characteristics may cause the efficiency to drop when the engine is overloaded by speed and grade.

23. Heavy motor vehicle operating characteristics on grades vary considerably, depending on the engine type, characteristics, and motive power per ton of gross vehicle weight.

24. Heavy motor vehicles operating at practically constant engine speed have definite characteristic road speeds depending on the percent of the grade and the power per ton.

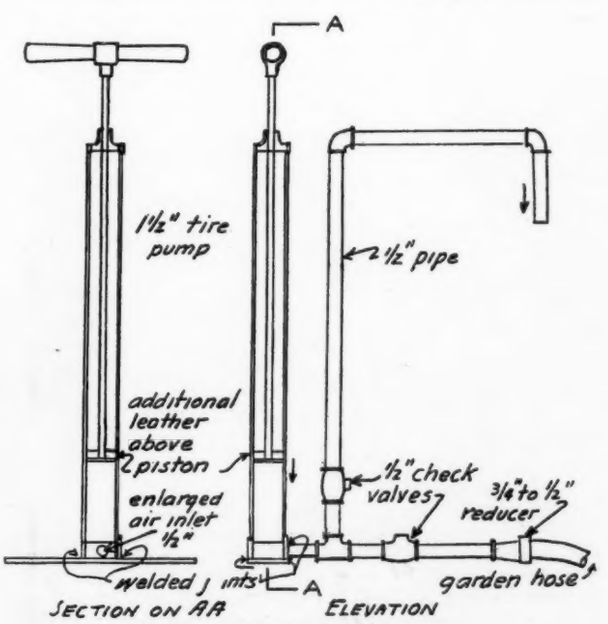
25. It is believed that the results of tests on heavy equipment conducted under actual operating conditions and modified by the methods of operation give more representative information than tests conducted at constant speed in each gear.

A Sludge Sampler

The device for sampling sludge in Imhoff or digestion tanks that is described herewith is suggested by the State Board of Health of South Dakota in its bulletin "The Clarifier"; which, however, does not claim to be the inventor nor does it know who was.

The sampler consists of a slightly altered automobile tire pump, two ½" check valves, one ½" tee, two ½" elbows, some ½" pipe, a ¾" to ½" reducer, and 25' of garden hose marked at one-foot intervals by means of tin bands (such as are used around chickens' legs) stamped with a die with numbers from 1 to 24. The air inlet at the pump base usually requires enlarging so that sludge can enter the pump freely, for which purpose the foot rests are cut off and a new one welded on the bottom as shown. An additional leather is placed above the piston so the pump can exert both suction and compression.

A ½" nipple is welded over the hole in pump base, a ½" tee screwed onto it, and a butterfly type check valve placed on each of the two pipes leading from the tee to prevent air entering through the outlet pipe on the up stroke and prevent sludge going down through the hose on the down stroke. If the pump is worked as the hose is lowered it is easy to tell when the latter reaches sludge level. A sample of any amount can be taken at any depth. This sampler can also be used for any purpose about the



How to build the sludge sampler

Turn to pages 55-57 for descriptions of helpful booklets and catalogs.

plant where a small hand pump is needed. As leathers and possibly cylinders may need to be replaced at intervals, a standard make of pump should be used. The entire sampler can be made for about $7.00, including a dollar pump and $1.25 for 25 ft. of hose, and about $1.25 each for the check valves.

Sewerage and Air Conditioning

NUMEROUS papers have been presented recently before the various water works associations calling attention to the demands for water being made by air conditioning installations; but little has been said about the effect of these upon capacities of sewers and treatment plants. Both the water demand and used-water disposal problems are considered in a report just issued by the Department of Commerce giving the results of an investigation of the "Effect of City Water and Sewerage Facilities on the Market for Air-Conditioning Equipment." Some of the facts and conclusions contained in that report are given below.

Not only city water used for air conditioning, but in most cases that obtained from private wells also, is discharged into the public sewers. This "has in some cases placed so great a burden on the sewerage facilities that it has become necessary to place limitations on the further installation of water-using air-conditioning plants either in the community as a whole or in certain particular sections of the city." In Chicago, with only about 16% of the Loop district air-conditioned, on July 26, 1936, as well as a number of other days that summer, so much air-conditioning water was discharged into the sewers of that district that they could not carry it all and many basements were flooded.

Not only the sewers, but the treatment plants also may be taxed beyond capacity. The peak flows will be greater and more irregular in times of occurrence than those of ordinary sewage. In winter there will be little use of such water; but in summer the amount will vary with the temperature from day to day.

The amounts of water that would be required for universal air-conditioning by means of equipment relying on it for cooling is so enormous that it is not believable that such equipment will continue to be used as conditioning becomes general. Engineers of the General Electric Co. estimate that the *present* air-conditioning equipment of the country has a potential water demand of 2,000 mgd or approximately one-half as much as the combined consumption of all cities of over 100,000 population. A small residential plant capable of cooling and air-conditioning one large or two small rooms will consume more than 4,500 gpd; or, assuming 5 persons to a residence, 900 gpd per capita, or about ten times the normal water consumption.

Either supplying that much water or handling that much sewage for a half or even a quarter of the population of a city is impracticable in most cases and may be impossible; and it would seem to be self-evident that the general adoption of air-conditioning is conditioned on the use of plants that do not rely on water for cooling unless it is used over and over again by the use of cooling towers. According to the figures given in this report, about 60% of the installations now in service use such towers or are self-contained, so that the practicability of such equipment has been demonstrated.

It behooves cities to consider this subject carefully. Unless they are the exceptional ones which can supply and remove unlimited quantities of water, it would seem wise to forbid the use of water-cooled air-condi-

tioning plants. To do otherwise is only laying up trouble for themselves, for the users of such plants and for the manufacturers. Those cities which at first allowed roof water to be discharged into their sanitary sewers temporarily, and then tried to prevent it when the sewers became overcharged by too many connections, will need no elaboration of the first point. When the time comes that such plants must be forbidden, property owners who are using such plants will lose the capital invested in them; and manufacturers who have built up a business in manufacturing and selling such equipment will see that business vanish.

So far, the problem seems to have been studied only from the supply end. But, to provide for the cases of supplies taken from private wells and discharged into the sewers, it would seem desirable to consider the removal end, and forbid the discharge of air-conditioning water into the public sewers.

(These conclusions are ours, not those of the Dept. of Commerce, which discusses the matter from the point of view of the manufacturers of equipment.)

Making Ferric Chloride at the El Paso Treatment Plant

THE coagulant used at the sewage treatment plant of El Paso, Tex., is ferric chloride, made by passing chlorine solution through iron borings and turnings purchased from the railroad shops; the chlorine being bought in ton containers, which come 15 to a carload. The procedure and experience with it were described by Chas. D. Yaffe, superintendent of the plant, in a paper before this year's Texas Water Works Short School, from which the following is abstracted.

The ferric chloride generator consists of three cylindrical tanks 36 inches in diameter and 12 feet deep, made of vitrified pipe, two of them filled with iron shavings. Chlorine solution (from Wallace & Tiernan chlorinators) enters these two tanks at the bottom and passes up through the iron, forming ferrous or ferric chloride, depending upon the rate of flow, chlorine concentration and other factors. The aim is to make ferrous chloride, which passes from the tops of these two tanks to the bottom of the third, where additional chlorine is added to convert the ferrous to ferric chloride, which passes from the top of this tank to the sewage.

When the chlorine solution is brought into contact with the iron, many things may happen—among them the production of hydrogen gas, which can cause considerable trouble. They found that, though the iron concentration in the product at first approximated the theoretical 2,800 ppm when using approximately 1 pound of chlorine to 40 gallons of water, it began to drop in about two hours and kept dropping until in 24 hours it had fallen to 550 ppm; while the production of ferrous chloride stopped entirely due to the excess of chlorine. The flow of chlorine was cut off and at once a tremendous amount of gas boiled out of the tank for about ten minutes. The chlorine supply was started again and the iron content rose quickly to 2,000 ppm but in two hours dropped to 1,000. It is believed that hydrogen gas gradually coats the iron shavings and prevents the chlorine from coming in contact with them, but for some reason the hydrogen leaves the iron when the chlorine solution ceases to flow through it. The gas can be caused to escape by stirring the iron shavings with a long bar, but this is difficult. "We are thinking of running an air line through the iron and blowing air through it at intervals in an attempt to

flush the entrapped gas out. At present we are alternating the flow through the two iron tanks every two hours, and stirring the iron with a bar about every hour. This is giving fairly good results, and we are able to keep the feed solution fairly uniform in composition."

When ferrous chloride comes in contact with hydrogen sulfide, ferrous sulfide is produced, which is black, and a black appearance of the sewage indicates that insufficient chlorine is being added to convert all of the ferrous chloride to the ferric state. On the other hand, odor of chlorine gas indicates that too much chlorine is being added or that the iron needs stirring. The procedure indicated gives about 2,000 ppm of ferrous iron in the two iron tanks, which is oxidized to about 1,400 ppm of ferric chloride in the third tank. The ferric chloride cost about 4.3 cents per pound with iron costing 3 cents and chlorine 4 cents per pound.

Curing Concrete with Calcium Chloride

THE American Society for Testing Materials, at its annual meeting this year, adopted revisions to its standard specifications for curing concrete by use of calcium chloride, to bring them in line with developments in such use and in research during the past few years. The specifications for the surface method are known as A. S. T. M.-C 83-37, and those for the admixture method as C 82-37.

The original specifications for the surface method required that burlap spread on the concrete remain saturated while in place; which provision, if followed, would have insured the presence of sufficient moisture to cause immediate dissolution of the calcium chloride. For convenience, however, contractors prefer to have the burlap as dry as possible at the time of removal, which fact made the enforcement of this provision difficult. The revised specifications require that the concrete surface be sprinkled just prior to the application of the calcium chloride; that is, following the removal of the burlap. This will insure immediate dissolution of the calcium chloride, and permit the use of a less amount (1½ lbs. per sq. yd. in place of 2 lbs.) for complete and uniform coverage of the pavement surface. This makes it satisfactory to use this method under low humidity conditions (for which it formerly did not apply) since it provides complete covering of the surface and blankets the pavement, due to controlling the vapor pressure, so that the mixing water in the concrete is prevented from evaporating. The reduction in the amount of calcium chloride required reduces the cost of this method.

The specification for the admixture method, as revised, permits the use of the dry flake as well as the solution form of calcium chloride. When the use of calcium chloride for integral curing was first started, the material was manufactured in the granular form only, and in such form it was necessary that the material be thoroughly dissolved prior to being incorporated in the concrete mix. For many years, however, all manufacturers have produced flake calcium chloride conforming to the requirements of A.S.T.M. specification D98-34. As a result of the rapid dissolution of the product conforming to this specification, calcium chloride may be added directly to the mix in the dry form.

This improvement in the handling of calcium chloride in the dry form makes this method of curing particularly practical for small as well as large projects. The material may be proportioned and cared for in the same manner as the cement. It can be packaged in the proper amount for each batch or weighed into the mixer with the other materials.

The revised specification promotes the more efficient use of calcium chloride in that it recognizes the fact that the prevailing temperature affects the amount of calcium chloride necessary to attain maximum benefit. The specification recommends that calcium chloride be used as follows: for temperatures below 80° F., 2 lbs. per sack of cement; 80° to 90° F., 1½ lbs., and for temperatures above 90° F., 1 lb. per sack of cement.

Hardpan Not Shown by Drawings

Under a construction contract which specifically stipulates that the city does not guarantee the completeness or correctness of the borings, or of the results thereof, the city is nevertheless liable, under New York decisions, if it knowingly misrepresents the conditions, or if it withholds from the contractor any material information of which the city had knowledge and which if disclosed would have tended to indicate the incorrectness of the boring sheets attached to the contract. In other words, it is required that the city shall act in gool faith.

In an action for damages claimed to result from the increased cost of excavation due to the presence of "hardpan," there was no claim or finding of misrepresentation on the part of the city, and no showing of knowledge by the city's inspectors of the existence of "hardpan." The New York Supreme Court, New York County, Arthur A. Johnston Corp. v. City of New York, 296 N. Y. S. 547, held that while for misrepresentation or concealment a contractor may have redress, honest mistakes, unavoidable or careless, comes within the risk he assumes. To discover the existence of hardpan is not a simple matter, requiring experience and a rather high degree of skill and accuracy of procedure. It was held that there was no bad faith, but an honest mistake on the part of the city's employee, which if negligence should be assumed, did not rise to the equivalent of fraud or bad faith.

A Yellow Asphalt Crossing

Pedestrian crossings have provided scope for considerable ingenuity in the matter of design, materials used and color. Color is important, as these crossings must be conspicuous. They must also be non-slippery. On account of the limited area covered, the question of cost is not so important as is the case when a whole street has to be carpeted. In trying out any new material the first cost is usually much in excess of what it would be if demand justified its preparation in bulk. The pedestrian crossing, therefore, offers a unique opportunity for experimental work. By reason of its position, it comes in for harder wear than other parts of the street, for the usual street refuge forces the traffic into two narrow lanes, which in the old days would lead to rutting.

The very latest in pedestrian crossings is one laid in Finsbury by the Neuchatel Asphalt Co., Ltd. It consists of a yellow asphalt ½ in. thick superimposed on a mastic asphalt base. Previously the crossing was marked with the usual steel studs, but, owing to complaints that it was not sufficiently conspicuous, the Finsbury Borough Surveyor, Mr. A. V. Cole, A.M.I.C.E., decided to try out the Neuchatel new yellow asphalt mix, in which cadmium oxide, an intensely yellow pig-

Turn to pages 55-57 for descriptions of helpful booklets and catalogs.

ment, is employed as the coloring agent, with excellent results up to the present. The pigment is expensive, but, should the material, as laid, retain its color (and there appears to be no reason why it should not), its use will probably be extended for such purposes as traffic lanes, when it will be less expensive than the present practice of frequent painting.—*Highways and Bridges.*

Manhole Spacing and Catch Basin Construction

IN RESPONSE to a recent questionnaire from the Editor of Public Works, the city engineers of more than 900 cities gave data in regard to details of sewer system construction. One of the questions asked had to do with the spacing of manholes on new sewer lines, and the information below shows the maximum distance reported for any one city in each state, the minimum spacing generally used, and the average of all replies.

Another question had to do with present practice in regard to building silt or grit traps in catch basins. A third question, to be summarized in another article, covered the practice in storm sewer design—rainfall rates, runoff coefficients and methods of calculating capacity required.

State	No. of Cities Replying	Manhole Spacing Max.	Min.	Aver.	Are traps built in catch basins? Yes	No
Alabama	8	600	300	350	..	5
Arizona	3	300	300	300	1	1
Arkansas	8	350	300	320	4	3
California	49	660	200	382	19	21
Colorado	10	400	300	336	3	6
Connecticut	9	500	250	320	7	1
Delaware	1	300	300	300	..	1
Florida	12	400	200	308	7	3
Georgia	18	500	300	370	6	6
Idaho	4	400	300	350	..	3
Illinois	44	500	250	340	26	7
Indiana	28	400	150	313	19	5
Iowa	24	450	250	340	12	12
Kansas	27	530	150	320	7	14
Kentucky	13	500	200	340	4	5
Louisiana	4	400	200	300	2	2
Maine	8	500	275	315	7	1
Maryland	1	400	400	400	..	1
Massachusetts	37	400	200	270	27	4
Michigan	51	500	165	335	41	6
Minnesota	44	410	100	315	20	16
Mississippi	3	300	300	300	3	..
Missouri	21	400	300	335	7	7
Montana	10	400	260	325	6	3
Nebraska	22	500	300	403	15	5
Nevada	3	300	300	300	2	..
New Hampshire	5	400	150	262	2	1
New Jersey	41	500	100	260	20	16
New Mexico	5	450	300	360	4	1
New York	60	400	100	300	38	17
North Carolina	16	500	200	370	6	8
North Dakota	7	400	360	376	6	1
Ohio	46	500	200	355	28	15
Oklahoma	16	400	150	293	6	5
Oregon	10	400	200	315	7	2
Pennsylvania	94	600	150	342	49	28
Rhode Island	2	200	150	175	1	..
South Carolina	9	400	250	312	2	7
South Dakota	8	450	300	375	6	2
Tennessee	8	500	300	360	..	8
Texas	35	1200	300	590	8	19
Utah	7	300	300	300	3	3
Vermont	6	400	300	350	6	..
Virginia	22	500	250	340	12	7
Washington	15	500	300	350	7	4
West Virginia	4	400	250	312	2	1
Wisconsin	37	450	150	311	27	9
Wyoming	4	500	...	...	1	3
	919			332	472	298

Some Essentials in the Management of Water Distribution Systems

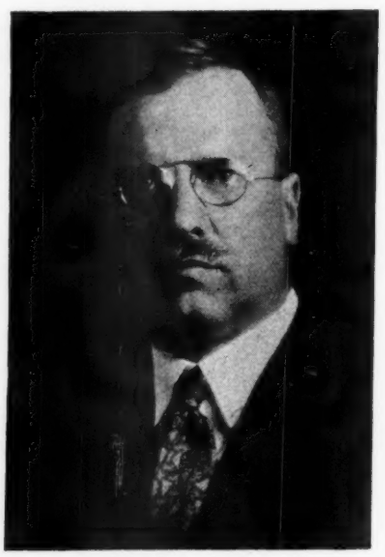
By WILLIAM T. FIELD
Consulting Engineer

IN THE management of water distribution systems, as in the designing and constructing of them, it must constantly be borne in mind that they have several functions to perform. The most important of these is to provide, for domestic consumption, water of high sanitary quality, agreeable in taste and pleasing in appearance. Second in importance is fire protection, which requires provision for supplying an ample quantity of water whenever needed; which in the smaller communities almost always involves need for storage capacities, pressures and pipe sizes greater than those necessary for domestic consumption. A third purpose is to provide water of the quality and in the quantity needed for industrial and commercial uses.

While the third purpose is not strictly a function of municipal government, it is generally highly desirable for municipal as well as privately owned plants, in that industrial and commercial plants are an essential feature of modern civilization and furnish employment to many in the community. Also, income received from the water sold to such establishments should help to carry the cost of furnishing water for fire protection, street flushing and other community uses and permit reducing the charges for domestic consumption.

While theoretically "management" might not be considered to include designing and construction, in a growing community extensions and additions must be made continually to maintain adequate service to all citizens, and, except for major improvements, are ordinarily planned and constructed by those responsible for the management. Intelligent planning for such improvements, whether made by the regular force or by consultants employed for the purpose, necessitates information concerning past rates of water consumption, from which to estimate probable future demands; capacity of the source of supply and data concerning possible sources available for supplementing it; the actual carrying capacity of the various mains and principal feeders, both past and present; pressures in the various parts of the system, as existing and as likely to exist with increased consumption; fire protection facilities as regards hydrants and water supply. Also, since the mains to be added must be laid underground, knowledge should be kept up to date concerning the presence and exact location of other underground structures such as sewers, power and telephone conduits, etc.; also concerning the pavements on the streets involved; and underground conditions such as presence of rock, quicksand, groundwater, etc.

To collect and have ready for reference the details concerning all these requires the continuous collection of such data and recording them on maps, filing cards, etc. There will also, of course, be a map of the distribution system kept up to date, and records and detail maps showing the exact location of all pipes, valves and other features of the system.



William T. Field

Mains and Distributing Lines

When distributing pipes no longer permit the delivery without undue loss of pressure of an adequate supply of water to any and all parts of the system, with allowance for several years' growth, something should be done about it—generally they should be replaced with larger pipes or a reinforcing main be constructed; or possibly the capacity can be increased by cleaning the pipe. It is not always possible, in a system cross-connected at frequent intervals (as most systems should be), to compute the capacity of the lines; but a study of pressures at various points in a section during the hours of heaviest consumption, with hydrants closed and with one or more of them open, will give conclusive information concerning the need for additional main capacity.

Cross-connections are desirable, in that they give more dependable service, allowing by-passing of leaking or broken mains for repairs; better fire protection; and permit water to circulate throughout the system, preventing tastes that may result from dead or stagnant water in dead ends. But dead ends cannot always be wholly eliminated, for water must sometimes be supplied where it is impractical to cross-connect. Dead-end pipe must be large enough to supply a fire stream unassisted, for which at least a 6-inch line is needed—larger if the line is more than 400 to 600 ft. long.

Generally speaking, no pipe less than 6 inches in diameter should be installed in a distribution system to which fire hydrants are connected. One exception is where there are two mains in a street, one on either side. In this case one distribution main furnishes fire protection and the surplus of capacity for peak periods of consumption; while the distribution main on the opposite side of the street need be no larger than is needed to supply the necessary water to the homes served by it.

In thinly populated sections a main can be laid, preferably of salvageable material, smaller than that which will ultimately be required; and later, when a larger main becomes needed, the smaller one can be dug up and used elsewhere. In some areas fire protection can be provided by placing large mains in every third or fourth street, which will serve as feeders for the hydrants, while in intermediate streets water for domestic consumption can be furnished by small pipe, to be replaced by larger ones when increase in such consumption demands it.

Cleaning and Flow Capacity; Leaks

In some sections the water is of such character that mains lose some of their capacity every year, due to tuberculation or deposits in the inside of the pipe, which reduces the effective diameter and capacity. Tests should be made at regular intervals to determine flow coefficient and pipe capacities of all mains. These can be made by any properly equipped water department or by firms that specialize in the work. Results should be plotted on cross-section paper; and comparison of curves so plotted over a period of years will show exactly what change is taking place in the capacity of the pipes in that community, aiding greatly in planning for cleaning, replacements, etc.; and for determining the necessity for special linings, as cement or enamel, in new construction.

Leakage tests may be made at the same time that flow coefficients are being determined, and much "unaccounted for" water saved. Stoppage of leaks often permits postponement of otherwise necessary construction.

Laying Pipe

In the laying of pipe, care should be used to see that the pipe is properly bedded, no contact or possibility of future contact with rock being permitted. All joints should be carefully cleaned before making up and where poured joints of lead is used, it should be firmly caulked. Where sulphur base compounds are used, care should be used in preventing overheating. With all poured joints it is advisable to use braided hemp. With gasket and special couplings, care should be taken to see that a clean, straight joint is made before deflection, if a deflection is to be made. With ma-

When writing, we will appreciate your mentioning PUBLIC WORKS.

chined bolted joints, the machined ends should be carefully cleaned before connecting and then the bolts tightened up, but not so tight as to over-strain the lugs or rings. Care should also be taken in using some makes of pipe, not to deflect the joint so that it might leave an opening and thus cause a leak.

Generally it is better practice to install water mains on the side of the street rather than in or near the center; it eliminates cutting the pavement and the cost of replacing it, and in case of future repairs or changes, makes the work more accessible. There is also less frost penetration on the side of the road, and hence it is easier to obtain adequate protection from frost.

A stock of supplies should always be kept on hand, or at least of those that can not be obtained on short notice. Included in that stock should be several lengths of each of the different sizes of pipe used in the system, together with joints or jointing materials. Also a number of the various specials, and sleeves for repairing broken mains. At least one or more of each of the various sized gate valves and boxes should be available, as well as a standard hydrant; all of which could be used for parts, or intact. In case of use of any of these, the stock should be replenished at once. A pot for melting joint material, tools for general work and pipe tools should be kept on hand; also a tapping machine and a stock of house connection material. A complete inventory of material and equipment on hand should always be kept up to date.

All pipe should be thoroughly examined and tested before placing in the trench, and after being installed should be covered with at least eighteen inches of dirt, free of stones, and where laid through rock should be bedded on at least six inches of earth. All specials, valves and hydrants should be braced to prevent movement until the backfill has properly settled in place. All mains and appurtenances should be disinfected before being placed in use.

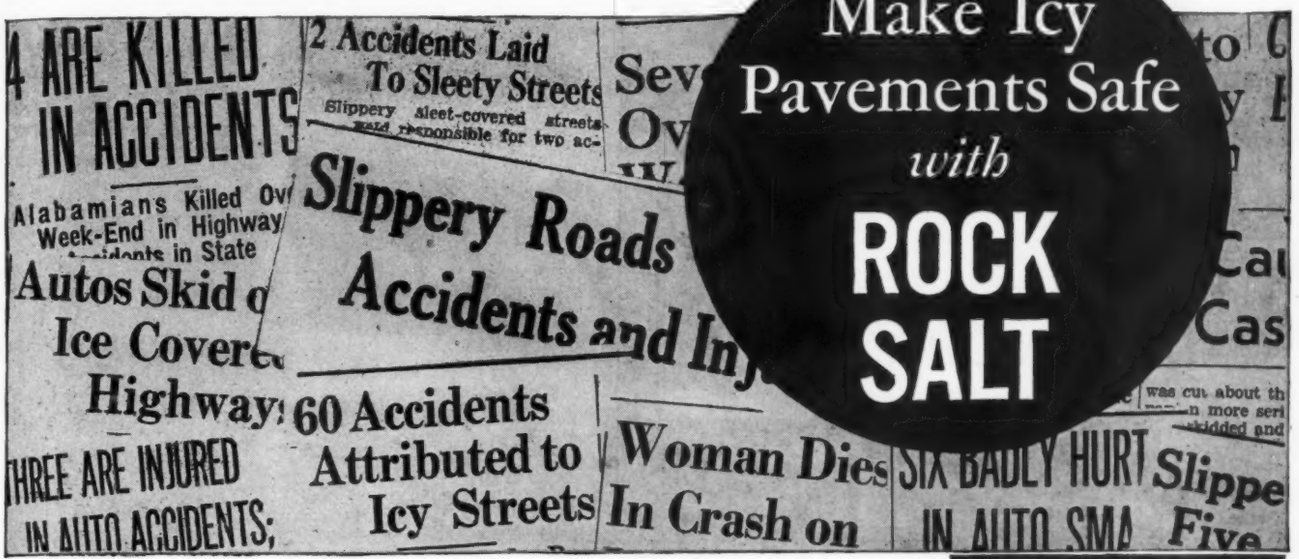
Gate Valves and Hydrants

Gate valves with boxes should be installed at all pipe junctions. For instance, at a tee connection there should be three gate valves and at a cross-connection there should be four gate valves, one on each branch from the connection; and where there are long runs of pipe between connections, one or more valves should be installed so that the distance between valves does not anywhere exceed 1,500 feet; and in thickly populated sections, or sections containing commercial or manufacturing buildings, the maximum distance should be 500 feet. In important locations under paved streets, it often is advisable to build manholes around the valves.

One very important item in a water system is that of hydrants for fire protection. While the saving made to the residents of the municipality by adequate fire protection is not reflected in the tax rate, it nevertheless is reflected in reduction of fire losses and insurance rates and is of major importance. Adequate fire protection involves sufficient size of mains, as already stated, and also of hydrant connections, which should be not less than 6 in. and in some cases larger. The hydrant itself should have a valve opening not less than 5 inches diameter. Every hydrant connection should have a gate valve in order that repairs or changes may be made on the hydrant without interfering with the use of the main.

The hydrants should be of a type that will not leak when broken off and should have at least two 2½-inch

STOP THIS LOSS OF LIFE AND PROPERTY



FROM Maine to Alabama, wrecked automobiles pile up a shocking total of death and injury as well as property damage during the winter months. Ice, snow and sleet take a grim toll everywhere.

Years ago International Salt Company, Inc. recognized the problem that was facing street and highway officials due to increased motor travel in the winter. International offered the services of its Research Laboratory to work in cooperation with public officials to cut down the appalling number of winter accidents.

This study and practical experience have proved that the use of Rock Salt is the most practical, most effective and most economical way to make winter streets and highways safe. Rock Salt has been found to be the most effective chemical now used for embedment of abrasives to make non-skid surfaces on icy and snowy roads. Rock Salt melts ice more effectively—honeycombs and undercuts the ice without leaving slippery surface puddles. Traffic quickly crushes this honeycombed ice which can be easily and rapidly removed.

Tests made by the Maintenance Committee of the Highway Research Bureau are shown in a table which is part of a new book prepared by International Salt Company, Inc. The table shows that, pound for pound, Rock Salt is more effective than other chemicals at the usual winter temperatures. Write for this book, and any information you would like about the effectiveness, and economy, of using Rock Salt for making winter streets and highways safe. International Salt Company, Inc., Scranton, Pa.

3

Reasons why Rock Salt is preferred for winter safety.

ECONOMICAL
Costs far less than any other usable chemical.

EFFECTIVE
Longer-lasting embedment action prevents freezing of abrasive piles—retains melting power longer—melts more ice, pound for pound, than other usable chemicals.

SAFE
Used alone or with abrasives in winter for the utmost safety.

What Practical Officials say about International Rock Salt for Ice Removal

"Manholes, car tracks, etc., make it impossible to remove all snow by ploughing. We prevent ice formation by using rock salt, and make dangerous streets and crossings safe with rock salt and cinders."
Street Commissioner, Large Industrial City

"I have used rock salt mostly with sand for slippery roads and around culverts for forty years, and found it very satisfactory."
Superintendent of Highways, New England City

INTERNATIONAL ROCK SALT

INTERNATIONAL SALT CO., INC.
Dept. 9P, Scranton, Pa.

Please send me a free copy of "Make Icy Pavements Safe with Rock Salt."

Name——————(PRINT PLAINLY)——————

Title——————

City——————*State*——————

Turn to pages 55-57 for descriptions of helpful booklets and catalogs.

hose connections, and generally a steamer connection also. The hose connection thread should be in accordance with the National Board of Fire Underwriters' standards, and the other parts also.

The hydrant should be set on a firm base such as a flat rock or block of concrete and surrounded by loose stones or gravel at the base to provide adequate drainage for the hydrant drip, and should be braced on the opposite side from the pipe connection. It is good practice to provide sufficient height of hydrant so that the hose connections will be far enough above the ground surface to permit the hose to be connected easily, even in the winter when there may be considerable snow.

Hydrants should be so spaced in residential sections that all buildings are within five hundred feet of a hydrant; and in selecting the location, consideration should also be given to the visibility—that is, the hydrants should be at street intersections wherever possible in order that they may be seen from two or more directions. If there is any question of distance, it is better not to gamble but to use another hydrant. This does not mean close spacing but judicious spacing. In commercial districts the hydrants should be placed considerably closer, and in many cases hydrants, main connections and hose service should all have greater capacities.

Both the hydrants and valves should be examined and inspected periodically, especially just before winter.

Serving Different Levels

Some municipalities are located on areas having such wide differences in elevation that excessive pressure would occur in the lower sections if adequate pressure is supplied to higher sections on the same distribution system; wherefore it is necessary to divide the system into two or more levels, generally controlled from one or more storage reservoirs. Some systems supply the lower level or levels from the higher level through pressure reducing valves which have by-passes to open up, if necessary, in times of fire. Other systems have different storage provisions for the different levels and in addition have the levels connected by pressure-reducing valves or simply have regular gate-controlled connections; however this latter does not represent the best practice.

With gravity supplies, the water may be brought directly to the various storage tanks for the different levels or through the distribution systems to them. With a pumped supply, it is advisable to have separate pumps serving the various levels.

Metering

All water systems should be completely metered, including both supply mains and service connections; and the municipality should exercise its control of supervision on service pipes into the customers' property to, and including, the meter. The fact that a system is one hundred per cent metered does not mean that the water will cost the customer more; in fact it may cost less, as metering is really keeping an accurate record of the water furnished to the system and that sold to the customer, which aids in preventing leaks and wastage.

Domestic meters should not exceed ⅝ inch in size. The minimum diameter of service pipe is generally ¾ inch, but the size of the meter should not be determined by the size of pipe used but upon the amount of water to be delivered; the smaller the meter, if it will adequately deliver the necessary water, the more accurate

the meter reading. Small volumes of water supplied through large-capacity meters cause slippage and low registrations.

Storage and Reserve

On small distribution systems, the storage should be as nearly as practical on the opposite side of the system from the supply. If this is not possible, the distribution system should be designed so as to balance the flow from both the supply and the storage. This is of great importance from a fire protection standpoint, resulting in an increase of the volume of delivery.

Storage reservoirs may be any one of several types, such as standpipes, elevated tanks, open concrete and covered concrete. Steel standpipes and elevated tanks may be either riveted or welded. Many of the latter are in use and giving very satisfactory service as well as having cost less. Ordinarily where there is a sufficient height of ground, a steel standpipe is the most economical storage, especially where the diameter and the height about balance. But when it is necessary, in order to obtain sufficient pressure, to build the standpipe of so great a height that the lower third or half is not effective for storage, then an elevated tank should be considered. Where there is a choice between a standpipe on a distant high hill and an elevated tank on a lower but nearer one, the decision will often be determined by the contract price or some local condition.

Construction of open concrete reservoirs requires very close personal attention to both labor and material and on smaller systems these usually cost more than steel construction. On larger systems where reservoirs of considerable capacities are required, concrete reservoirs are economical in cost and may be constructed of poured concrete or may be built up with reinforcement and a cement gun. Covered concrete reservoirs are desirable with water that is susceptible to algae growth. The roofs are usually covered with earth and sodded.

The size or capacity of a storage tank or reservoir should be proportionate to the service expected from it. Generally speaking there should be sufficient storage capacity to supply the municipality for several days, say three at least, and also take care of a fire of major size.

Water Supply and Sewerage in Maryland

According to the report for 1936 of the Maryland State Department of Health, 75.2% of the total population is served by public water supplies, about 95% of these with water which has been given some form of treatment. Sewerage systems serve 72.1% of the population and the sewage from 64.5% of the population receives some form of treatment. Just about half of the population of the State lives in Baltimore, whence it would appear that about half the population outside that city has public water supply and sewerage service.

The typhoid fever death rate last year was 0.9 per 100,000 in Baltimore and 2.2 outside that city. Since 1929 the typhoid death rates of the State outside of Baltimore have been from 2.3 to 7.7 times those of the city alone. These rates have been reduced at a fairly uniform rate since 1910, when they were 41.9 and 43.5 respectively—a reduction of nearly 98% for Baltimore and 95% for the rest of the State in 27 years; or, if we compare the averages of the first five and last five years of that period, 96.7% and 90.1% respectively.

Preparing the Water Works for Winter

PREPARATION of waterworks structures against the advent of freezing weather may be of four general classes: 1. Seeing that devices or provisions that are supposed to operate automatically during cold weather are in condition to do so; that is, prepare them now to do their work under the severe conditions to come. 2. Putting in place or in service those items that are expected to function only during the winter. 3. Doing now those things which are needed and are much more difficult or expensive to do under winter conditions. 4. Seeing that equipment and materials are on hand and ready for immediate use for emergency work.

Among the first may be included attention to fire hydrants—see that the drip works and that the escaping water drains away quickly; see that the gate closes tightly; clean and repack the stuffing box; remove weeds and rubbish from around the hydrant; see that the barrel and especially the top have a coat of bright paint that will be easily visible against a background of snow. Some superintendents pour a salt or calcium chloride solution in hydrants that may be expected to freeze.

Check the condition of all valves, especially the more important ones. This should be done annually, of course, but see that it is completed before freezing weather arrives. See that the intake screens and the spillways of reservoirs are cleaned of leaves and trash after all the leaves have fallen. If there are provisions for preventing frazil ice trouble, as an ice fender or air or steam piping, see that these are in operating condition.

If there are leaks to be repaired or mains or services to be lowered to prevent freezing, do it now. A spot-map of frozen mains and services of previous years or of last year may help to locate probable sources of trouble for the coming winter. If mains on bridges or other exposed places (and also risers to elevated tanks) are or should be protected with insulation, see that this is in effective condition before that first cold spell.

Chlorination equipment must be kept above 50° and the chlorinator ought to be warmer than the chlorine cylinder. See that provisions for this are installed. Write the maker of your chlorine equipment for full details.

If pumps are operated by overhead power lines, see that the poles are in good condition to resist storms and ice and snow loads; and test the standby pumps to see that they are ready for instant use, even in cold weather; also the engines. If these are not in heated stations, see that the standby pumps and engines are drained or the latter alcoholized to prevent freezing. Also, that the packings, grease cups, etc., are in good shape, and if lubrication is changed for cold weather operation, do this in plenty of time.

Among the second class can be mentioned closing, draining and covering drinking fountains, ornamental fountains and other exposed water outlets.

Ice-covered reservoirs cannot absorb oxygen from the air and organic matter in them may putrefy and cause odors and tastes. To avoid this, clear the shallow areas of vegetation, algae, etc., and blow off organic deposits from the bottom of reservoirs. See that watersheds are clean of all polluting matter (which spring rains will carry off with the snow) and that all sources of such matter are eliminated.

See that service boxes are cleaned out and covered. A box full of frozen dirt makes shutting off a service a difficult job.

Tanks, swimming pools and small concrete reservoirs are sometimes damaged by the expansion of water freezing in them: if they can't be drained, damage can often be prevented by floating logs scattered over the surface. The logs take the thrust of the ice.

Records of all valves and other underground features of the system are always necessary; in winter when snow covers the ground and digging is hard, accurate records and references are even more necessary. Locations should be referenced to objects easily found even when there are many inches or even feet of snow on the ground.

The third class includes most kind of outdoor work that should be done before spring—completing this year's program of laying mains, service connections, etc; completing lining of reservoirs, grading around them, etc; painting buildings, tanks and other structures; repairing roofs; building fences; laying walks; planting trees and landscaping; and putting roads and paths in shape. Arrangements for snow plowing the roads to reservoirs or other remote areas may be made with the street department.

Fourth class items include making provision for thawing services, mains and hydrants: laying in and maintaining supplies of fuel, chemicals and other materials essential to operation, and in quantities sufficient to last through any period of interference with traffic due to storms.

Thawing equipment has been described in *Public Works* and in the *Manual of Water Works Equipment and Materials*. At least one or two pieces of such equipment should be owned by every waterworks, unless the local power company will make definite arrangements for doing the thawing and has necessary transformers on hand. Equipment for thawing frozen hydrants is available in several forms. Picks and shovels, if it is necessary to use them, will receive extra hard use and should be in good condition and well sharpened. The same is true of other digging tools, which are conveniently operated by air compressors.

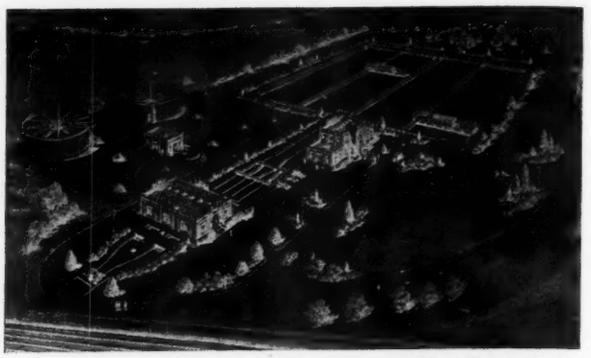
Proof of Stream Pollution

In order to sustain a recovery in an action based on the pollution of a stream, there must be a causal connection between the alleged pollution and the injury received. Furman Oil Co. v. Carman, Oklahoma Supreme Court, 65 Pac. (2d.) 963.

Turn to pages 55-57 for descriptions of helpful booklets and catalogs.

A Digest of Current Sewerage Literature of the Month

The Digestion Tank



Municipal Sanitation

Artist's perspective of Joint Treatment Works

Drying sludge cakes of 55% moisture to 12—15% moisture by hot air in Halifax, England, is effected by carrying broken cake on three endless band conveyors, built up of wire panels; through a drying chamber in which a temperature of 100° is maintained. Hot gases from a furnace are admitted to the chamber, mixed with the air therein by a fan on one side of the chamber, while four 4 ft. fans keep the air circulating and another withdraws it at the desired rate. Thermal efficiency, 45—49%. Dries 28 to 30 tons of cake a day.[D48]

Filter flies on the Minworth filters (England) are combatted by broadcasting common salt on the surface at the rate of 2 tons per acre; also by application of 5% gas liquor; in the period preceding the greatest fly activity. Also, by using distributors that keep the entire area of the bed continuously wet the number of flies escaping is substantially reduced.

Sewage given one hour's detention in an activated sludge tank will clean up a clogged filter, and such treatment doubles the capacity of the filters.[D50]

Sludge fertilizer is produced at Barnsley, England, from activated sludge of 99.34% moisture by mixing with it sharp-grained dust (partly phosphates) at the rate of 75.8 lb. per 1,000 gal. of sludge, allowing it to settle in a tank, decanting 75% of the supernatant, drawing off the remainder onto drying beds, then removing the air-dried sludge for further drying in sheds. This is sold at about $10 a ton. A contract has been made for 400 tons at 15% moisture at a price slightly more than cost including grinding, bags and haulage.[D51]

Joint treatment works serving 11 New Jersey municipalities, opened June 17th, include coarse bar racks, mechanically cleaned bar screens, mechanical grit removal, 4-hr. sedimentation, Meider sludge removal, scum removal, sludge storage with devices for loading vessels 4,400 ft. from the plant, and devices for dewatering sludge and destroying sludge storage gases; for a flow of 172.5 mgd. Sludge taken to sea in 3,000 ton loads, 30 trips a year, being stored between trips.[H72]

Bio-filtration (see PUBLIC WORKS for July, 1936) is utilized for the first time in a treatment plant recently placed in operation at the Camarillo, Calif., State Hospital. The plant consists essentially of primary sedimentation units, a trickling filter, detention-settling tanks, and separate sludge digestion. The trickling filter contains 3 ft. depth of 1½" to 2½" stone with a net area of 5,600 sq. ft., on which a rotary distributor discharges up to 3500 gpm. under a 24" head. An open grill underdrainage system affords abundant drainage and ventilation. In passing to the filter, the primary effluent receives four or more times its volume of effluent from the detention tanks, which in turn receive the effluent from the filter. The excess detention tank effluent goes to storage ponds for use in irrigation. "It is possible to work the bio-filter from eight to ten times the rate per cubic yard of filter material than is practicable with the trickling filter," secondary reactions taking place in the detention tanks. The recirculated effluent is also used to so dilute the raw sewage as to maintain any desired rate of flow through the primary sedimentation tanks. "Experience shows that when the detention period is 4 to 6 hr., a 0.75 hr. period is sufficient for adequate sedimentation." "Incidental operating characteristics of the plant include rapid digestion of the sludge without foaming; freedom from plant odors; and practical elimination of filter flies."[E18]

Sewer tunneling in soft clay in Detroit is progressing at an average speed of 50 ft. per 20-hr. day, using a 22 ft. shield and making a 16 ft. circular sewer. Clay squeezes through openings in shield when it is pushed ahead, 2½ ft. at each shove, drops into a car which is run to the shaft, raised, and emptied by turning upside down. Ground pressure ahead of shield, the top of which is 20 to 25 ft. below the street surface, is kept sufficient to raise the ground surface about ¾ in. to prevent settlement of streets and buildings. Lining consists of precast interlocking concrete blocks 18 in. thick, with an inner monolithic lining 16 in. thick, the concrete for which is supplied from the surface through bore holes, and placed over the arch forms by a pneumatic concrete placer. A total length of 10,215 ft. is being worked from one shaft in the center.[E19]

A two-story treatment plant has been built at Highland Park, Ill., to treat 900,000 gal. of sewage a day, on a site 50′x100′, the enclosing building being 48′-8″x88′-8″, and 54′-8′ high. Location between bathing beaches and near several fine residences. The plant includes screens, grit chambers, Imhoff tanks, chlorination contact tank, chlorine room, sludge pumps, 3,000 sq. ft. of sludge drying beds and sludge loading room. The last two occupy the second floor. The Imhoff tanks, which have a liquid depth of 22 ft., extend about 20 ft. below ground level. The screens and grit chamber are at one end of the tanks, the contact tank and sludge storage tank at the other. Sludge removed from the drying beds is dumped into a hopper at one end, and from this into trucks which can drive under it. Sludge is pumped from the Imhoff tanks to the beds above; all else is by gravity.[H73]

Bibliography of Recent Sewerage Literature

c, Indicates construction article; n, note or short article; p, paper before a society (complete or abstract); t, technical article.

D *The Surveyor*

July 23

47. *p.* The Rationalization of Sewage Disposal. By C. B. Townsend. Pp. 99-101.

August 6

48. Halifax Sewage Disposal Works. P. 159.
49. Lancaster Sewerage. P. 160.
50. Birmingham, Tame and Rea Sewerage. Pp. 177-179.

August 13

51. Sewage Disposal at Barnsley. P. 197.

E *Engineering News-Record*

July 29

18. Bio-Filtration at Camarillo, Calif. By H. N. Jenks. Pp. 183-187.
19. *c.* High-Speed Shield Tunneling (Detroit sewers). Pp. 188-191.

August 5

20. *c.* Sewer Tunnel Looped Under a Fault (New York). Pp. 220-224.

H *Municipal Sanitation*

August

72. Joint Treatment Works. By Alexander Potter. Pp. 400-403.
73. Skyscraper Sewage Treatment Plant for Highland Park, Ill. By J. W. Nemoyer. Pp. 404-406.
74. Iowa Experiment Station Reports on Treating Packing House Wastes. P. 406.
75. Sewage Plant Operation: Sedimentation and Chemical Precipitation. By W. H. Wisely. Pp. 407-410.
28. Safety Equipment for Gas and Fumes. By L. W. Van Kleeck. Pp. 411-414.
29. Status of Sewage Disposal in Massachusetts. By A. D. Weston. Pp. 417-418.

J *American City*

August

16. Glass Covers for Sewage Works: Design and Maintenance. By W. Kelsey. Pp. 51-52.
17. Admitting Trade Wastes to Sewers. Pp. 91, 93.

L *Civil Engineering*

August

8. Conduct of Design for the Columbus Sewage Treatment Works. By R. T. Regester. Pp. 578-580.

M *Canadian Engineer*

August 10

6. *p.* Partial Treatment by Activated Sludge Process. Pp. 15-17.

P *Public Works*

August

37. *n.* Sewer Bridges Marsh on Series of Caissons. P. 10.
38. Sewerage System and Treatment Plant as a Self-Liquidating Project. By J. W. Goodwin. Pp. 11-12.
39. Public and Private Cooperation in the Development of Sewage Treatment. P. 18.
40. *n.* Distillery Waste Troubles in Maryland. P. 39.

Municipal Contracts for Sewer Improvements

Under the New Mexico Constitution the City of Santa Fe was held to have power to make a contract for sewer improvements without the approving vote of the qualified taxpayers so long as the obligation was confined to the property benefited by the improvements. A sewerage system in a city as large and thickly populated as Santa Fe is so essential to the public health that its continuous operation is a governmental duty. The city could contract for sewerage improvement if it had funds available to pay therefor; and it has power to levy taxes. The constitutional inhibition goes only to contracting a debt without the taxpayers' approval. City of Santa Fe v. First Nat. Bank in Baton, New Mexico Supreme Court, 66 Pac. (2d.) 857.

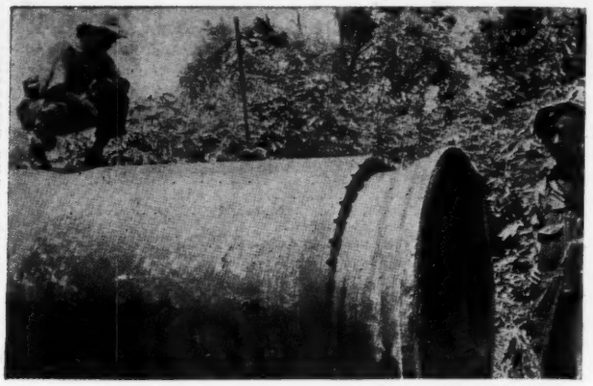
Contractors' Bond Coverage

The Indiana Appellate Court holds, Middle West Roads Co. v. Gradmont Haulage Co., 7 N. E. (2d.) 528, that a state highway contractor's bond given under the state statute covering claims for "labor performed and materials furnished" covers the value of the use of trucks used in hauling dirt from one place to another as might be required in the construction of the road.

The same court held, Metropolitan Casualty Ins. Co. v. Natural Rock Asphalt Contracting Co. 6 N. E. (2d.) 739, that the prepaid freight paid by an asphalt company furnishing rock asphalt to a highway contractor was "indebtedness," within the state statute providing that the contractor's bond should be conditioned for payment of all indebtedness for materials furnished in the construction of any highway, and was recoverable by the asphalt company under the bond.

The Water Wheel

A Digest of Current Waterworks Literature



Water Works Engineering

A 54" pipe cut by drilling

Slow sand filters were built by Greenfield, Mass., in 1935, with provision for coagulating during occasional short periods of turbidity reaching 150 ppm. or more. Slow rather than rapid sand filters were chosen: (1) Because the filters were on a hillside 5 miles from town, making constant attendance for washing, etc., difficult. (2) The color of the water is low, a chemical treatment for turbidity is required but about 1% of the time. (3) Treatment of slow sand effluent with chlorine is not required by the State Dept. of Health. (4) Misfits in treatment are less serious in their effects. (5) Difficult disposal of wash water is avoided. The plant is of 2 mgd. capacity; a 2-unit coagulating basin, two 0.2 acre filters, filtered water basin, filter house and appurtenances. During year of operation, alum applied at 12 ppm. 3 days in January and at 22.2 ppm. two days in March. Filters scraped twice.

A similar plant was built in 1936 in Northborough, Mass., filtering a polluted, highly colored water; chemicals are used continuously but without constant attendance, and "postponement of filter scraping may be made without the serious consequences that would follow failure to wash rapid filters at the proper times."[B15]

Wash water at the Salem-Beverly, Mass., filtration plant is discharged into three lagoons in a swamp adjoining the lake, which operate in series, the effluent from the third flowing into the lake. After operating 16 mos. the third lagoon had not yet filled because of seepage and evaporation, but the water in it appeared to be better than the lake water. They also receive sludge from the coagulation basins, some of which floated on the first lagoon (but later sank), and occasioned some odor. There has been no considerable amount of algae growth.[B16]

Prechlorination at Salem-Beverly for controlling tastes and odors resulted in larger (alum) floc formation, permitting the cutting of the alum dosage by several percent. Study is being made of the possibility of reducing total cost by making prechlorination standard practice. For odors due to microscopic organisms, best practice seems to be to destroy the organisms by prechlorination and then remove the odor by carbon, using 5.5 lb. per mg. of chlorine and 20 lb. of activated carbon.[B16]

Neutralizing CO_2 with lime rather than soda ash at Salem-Beverly was adopted because the low reactive power of soda ash would necessitate another dry feed machine and because of the economy of lime, of which 62 to 119 lb. per mg. is added, reducing the CO_2 to 0.45 ppm.; also increasing the hardness of the water from 36 to 44 ppm. Lime is applied to the filter influent with the idea of increasing the filter runs by coating the sand grains with lime to increase their size (which was 0.35 mm.); also by breaking down the size of floc, causing it to be carried deeper into the bed and taking longer to build up a solid mat. So far no cementing of sand grains or other deterioration of the bed has been noticed.[B16]

Chlorine leaking from ton containers would be dangerous unless controllable in some way. Immersion of container in a 20% solution of caustic soda has been tested in Chicago and found effective. Chlorine was fed at the maximum rate possible through a ¾ in. pipe (350 to 150 lb. per hr.) to a point 38" below the surface of a caustic solution, which was covered with a 0.5" layer of oil to reduce spattering hazards. Not the slightest trace of free chlorine was observed over the surface. When a cylinder was immersed and liquid chlorine escaped at a rate of 1,000 lb. per hr. the result was equally satisfactory. The oil prevented spattering but was completely emulsified to a froth.[E34]

Cutting 54" c. i. pipe by air drill in Atlanta, Ga., was done by use of a gasoline-driven air compressor, 105 cfm. capacity; air drill, hand feed, with chains and toggle lever locking device; 33 tapered pin wedges; 2 sledge hammers, and 2 freight car movers; operated by 5 men—compressor operator, handy man and 3 laborers. The pipe was rolled on skids by the car movers. 45 holes were drilled around the cutting line, average time to a hole 48 sec. The 33 pins were inserted and driven in succession by the sledge. Total time to split the pipe, 1 hr. 36½ min. Cost-labor, $4.95; gasoline, 53 cts.[F84]

The sight well at the first Baltimore Burnt Mills plant was originally painted with a white enamel paint, but this soon became discolored and failed to present its original attractive appearance. The well in the second unit was lined with white tile, and this proved so satisfactory that the well in the first plant has been fitted with tile also up to the water line, white enamel being used in both cases above the water surface. The bottom is lined with alternating black and white tile for better determination of the clarity of the water. A turbidity of 0.2 to 0.3 ppw. may readily be detected in the well.[F93]

Bibliography of Recent Water Works Literature

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

A *Journal, Am. Water Works Ass'n. July*

120. Progress in Federal Conservation of Water Resources, 1936-1937. By Abel Wolman. Pp. 915-941.
121. The Future of Water Allocation and Developments in Interstate Agreements. By D. E. Minard. Pp. 942-959.
122. International and Interstate Pollution Problems. By J. K. Hoskins. Pp. 960-979.
123. Fluoride Content of Some Wisconsin Municipal Waters. By D. J. DeWitt and M. S. Nichols. Pp. 980-984.
124. Fluorides in Illinois Water Supplies. By J. G. Weart and C. W. Klassen. Pp. 985-998.
125. Tap Sterilizer for Water Sample Collection. By C. Leipold. Pp. 999-1000.

WASHINGTON, also!

Construction scene in nation's capital, showing unskilled labor joining new trunk line with Dresser Couplings.

FROM COAST TO COAST!

Cities like these are establishing the trend to Dresser Couplings:

Camas, Wash.
Col. Springs, Col.
Columbus, Ohio
Huron, S.D.
Kansas City, Mo.
Yonkers, N.Y.

Another city where Dresser Couplings are being used to join new water mains is our nation's capital. Several Dresser-coupled lines, in sizes from 18″ to 93″, have been installed there since 1930. Especially proud are we of the new 31½-37-49⅜″ O.D. trunk main laid in 1936, also completely Dresser-coupled.

FIVE REASONS WHY MODERN WATER LINES ARE DRESSER-COUPLED:

1. PERMANENT TIGHTNESS—proved for 50 years, on 150,000 miles of pipe.
2. FLEXIBILITY—normal pipe movements—present in every line—are absorbed.
3. SIMPLICITY—joints are "factory-made"; ordinary labor can install.
4. STRENGTH—predetermined; joints safely withstand any specified pressure.
5. TRUE ECONOMY—a truly lower joint cost throughout the life of the line.

Write for our General Catalog No. 36.

Cutaway view of Dresser Style 38 Coupling, showing working principle. Note that plain-end pipe is used. The resilient gaskets, flexing with the pipe, safely absorb pipe movements.

THE MODERN TREND IS TO DRESSER COUPLINGS

S. R. DRESSER MFG. COMPANY, BRADFORD, PA. • *In Canada:* Dresser Mfg. Company, Ltd., 60 Front St., W., Toronto, Ont.

Turn to pages 55-57 for descriptions of helpful booklets and catalogs.

126. *t.* The Potassium Palmitate Test for Hardness. By M. Suter. Pp. 1001-1009.
127. Experiences in Filtration. By J. R. Baylis. Pp. 1010-1048.
128. Public Safety as Related to Waterworks Operation. By T. W. Coleman. Pp. 1049-1058.

B *Journal, New England Water Works Ass'n.*
June

14. *t.* Seepage Through Dams. By A. Casagrande. Pp. 131-172.
15. Construction of a Modified Slow Sand Filtration Plant at Greenfield, Mass. By H. L. Field. Pp. 173-184.
16. Operating Experiences at Salem and Beverly Filtration Plant. By R. P. Johnson. Pp. 185-199.
17. Activated Carbon. By E. A. Sigworth. Pp. 200-202.
18. Master Meters. By H. W. Griswold. Pp. 203-206.
19. Some Flood-Producing Storms of the Atlantic Seaboard. By M. W. Hayes and H. R. Byers. Pp. 207-209.
20. Meteorological Conditions During the March, 1936, and Other Notable Floods. By H. R. Byers. Pp. 210-218.
21. Development of the Ground Water Supply of Dayton, O. By W. W. Morehouse. Pp. 219-226.
22. Additional Water Supply for the City of New York. By W. E. Spear. Pp. 227-231.

D *The Surveyor*
August 13

Well Sinking in "Greensand" by the Mud Flush Rotary System. Pp. 193-194.

E *Engineering News Record*
July 22

35. *p.* Disinfection of New Water Mains. P. 146.

July 29

36. Thin-Core High Earth Dam. By O. M. Strange. Pp. 195-199.

August 5

37. What's Wrong in Water Works Management. By E. G. Plowman. Pp. 225-226.

August 12

38. Effective Water Works Organization. By E. G. Plowman. Pp. 269-270.

August 19

39. Forecasting Mountain Water Supply by Photographing Snowfall. By D. R. Gross. Pp. 310-311.
40. Improving Waterworks Management. By E. G. Plowman. Pp. 322-324.

F *Water Works Engineering*
July 21

84. *c.* Cast Iron Pipe Cut by Air Drill. Pp. 1032-1034.
85. *p.* Coagulation Aided by Silicates. By J. R. Baylis. Pp. 1035-1039.
86. Water Hammer Effectively Stopped by Special Check Valve. By M. C. Smith. Pp. 1042, 1069.
87. Laboratory Control: Identification and Control of Microscopic Organisms. By C. R. Cox. Pp. 1043-1045.

August 4

88. Recarbonation to Halt Deposits in Mains. By C. C. Lewellen. Pp. 1094-1096.
89. *p.* Public Accidents Cut 93% by City Water Co. By T. W. Coleman. Pp. 1097-1100.
90. *p.* Coagulation Aided by Silicates. By J. R. Baylis. Pp. 1101-1105.
91. Laboratory Control: Identification and Control of Microscopic Organisms. By C. R. Cox. Pp. 1106-1108.
92. New Supply and Filters Provided for Hoisington, Kans. By A. W. Hefling. Pp. 1124, 1127.

August 18

93. *p.* Operating Results at Burnt Mills. By C. A. Hechmer. Pp. 1158-1163, 1178.
94. Laboratory Control: Identification and Control of Microscopic Organisms. By C. R. Cox. Pp. 1174, 1177-1178.
95. Saline Pumping Station of Pittsburgh. By S. A. Canariis. Pp. 1189-1190, 1193.

J *American City*
August

16. Water for Industrial Purposes. By W. D. Collins. Pp. 55-57.
17. *p.* Water Works Operating Records for Progress and Protection. By R. L. Dobbin. Pp. 59-61.

L *Civil Engineering*
August

16. Technique of Soil Testing in Designing Earth Dams. By S. J. Buchanan. Pp. 568-572.
17. Colorado River Water for California. By J. Hinds. Pp. 573-575.

M *Canadian Engineer*
July 27

19. *p.* Recent Developments in Deep Well Pumping. By C. N. Ward. Pp. 9-11.
20. *p.* Maintenance of Hydrants and Gate Valves. By C. S. Gruetzmacher. Pp. 12-13.

N *Earth Mover*
July

1. *c.* Metropolitan Aqueduct (So. Calif.) 60% Complete. Pp. 19-22, 50.

P *Public Works*
August

39. Laying Water Works Main Across Railroad Yards. By A. D. Webster. Pp. 13-14.
40. Instructions for the Design and Construction of Small Dams. Pp. 21-24.
41. Legal Liability for Supplying Contaminated Water. Pp. 24-26.
42. *n.* Licensing Water and Sewage Operators in New Jersey. P. 49.

S *Construction Methods*
July

1. *c.* Pipe Launched on Inclined Ways at Toledo. P. 41.
2. *c.* Big Yardage by Small Concrete Crew on Roy B. Inks Dam. Pp. 44-47.

T *Technique Sanitaire et Municipale*
June

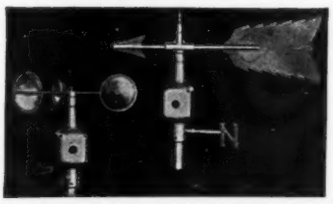
4. Réglémentation des Distributions d'Eau. By G. Monsarrat. Pp. 139-141.

W *Johnson National Drillers Journal*
July-August

3. The Chemical Analysis of Water (Elementary). Pp. 1-7.

Keeping Up With New Equipment

The "Airport Weatherman" has been designed for the precise practical needs of airports. It gives complete weather information. Illustrated are the directional signal and the instrument dials which register, at any desired point, the wind direction, wind velocity, outdoor air temperature and barometric pressure. While designed for airports primarily, these instruments are suitable for any commercial application.



Outdoor equipment above, and indoor below, Friez Airport Weatherman

The dials are black on white. Transmitters and indicators operate on 32-volt, 60-cycle, single phase supply only. This can be obtained from the standard 110-volt lines by transformers. Fuller information can be obtained from Julien P. Friez & Sons, Inc., Baltimore, Md.

For More Bituminous Roads

Littleford announces a new pressure distributor, the "TS". This is furnished in sizes 500 to 2000 gallons inclusive, for truck or trailer mounting, insulated or plain. It will handle all types and grades of road bitumen for heavy construction work.

The heating system consists of two large LB torch burners, each of which fires directly into a 6-inch diameter U-type return heat flue. Burners provide sufficient heat to raise the temperature of a tankful of material 3 degrees F. per minute. Less than one-third of a tankful can be safely heated.

Control of the pumping system is entirely governed by the Littleford single valve. With the control handwheel set at "spray," the full pressure of the pump produces instant action at the nozzles. By shifting to "fill" position, spray is cut off instantly and there is no dribbling at the spray bar because the suction of the pump sucks back into the tank all material in the lines. To aid in heating, set the handwheel at "circulate" and the pump draws hot material off the bottom putting it back in on top without passing through the manifold bar.

Pump and fifth wheel tachometer gauge the application accurately. Thermometers register application temperature. A patented by-pass built into the pump assures proper application pressure. Spray bars shift laterally and vertically. Any rate of application from 1/10 to 2 gallons per sq. yd., with spray bar lengths up to 24 feet can be had.

The operator's platform is high enough to keep him out of the smoke and fog. He can see both sides of the road. A fuel pump on the engine provides the correct amount of kerosene to the burners. No hand pumping or air pressure is required on the fuel tank. Spray bars couple on in a jiffy. The framework fits any standard truck chassis without alteration to the chassis.

For a descriptive bulletin (M-17) write Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio.

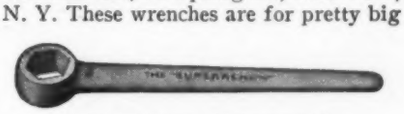
A Hopping Good Tamper

Here is something really new and unique—an explosion type tamper that hops about 18 inches vertically and is guided by the operator simply by inclining the machine in the desired direction. The compaction results are claimed to exceed any known specification. The picture herewith shows how it works. Weighs 220 pounds, but the makers say it can be controlled with one hand. Operates on benzol or aviation gasoline; ignition is by a 6-volt battery carried on the operator's back. The manufacturers recommend it for tamping trench and foundation backfills, and small fills; with a changed base it is handy for driving piles and sheeting; and for breaking concrete and similar work. They say that there are over 6000 in use. It is called the Delmag tamper and is furnished by the Calhoun Co., 1151 South Broadway, Los Angeles, Calif., who will send some interesting information on request.

The Delmag explosion type tamper

"Hex-Box" Wrenches

Shown is the "superrench," one of the large line of wrenches made by J. H. Williams Co., 75 Spring St., New York, N. Y. These wrenches are for pretty big work—openings range from 1¼ to 3⅛ inches. If you have a wrench problem, complete information can, we believe, be obtained from this company.



The Williams "Superrench"

Data on Curb Protection

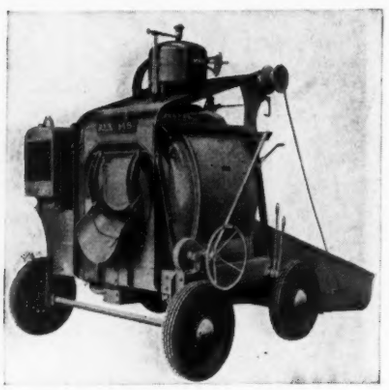
A malleable iron curb armor is said to permit narrow streets to be widened as much as a foot, by eliminating the granite curbs often used and replacing with this armor; it is also claimed that the jagged curbing, which is certainly tough on automobile tires, can be eliminated practically forever. Ought to be of particular value, too, on heavy traffic sections, bridges, bridge approaches, etc. This particular kind can be used on

New Littleford "TS" Bituminous Distributor

straight or curved curbs, regardless of curve radius. Chicago Malleable Castings Co., Chicago, Ill., can furnish installation data and sketches.

Streamlined Concrete Mixer

A very modern 14-S mixer, with its stream-lining and "shimmy" skip, and with automotive type steering. Features include a new and accurate type of water control and faster charging and discharging. It can be furnished for either end or side discharge (despite the "S"



Chain-Belt 14-S Mixer

designation), and with pneumatic, solid rubber or steel tires. Motor is 25 hp. The Rex batchmeter and centrifugal water pump are optional. The technical description employs some ponderous terms; it can be obtained from Chain Belt Co., Milwaukee, Wisc., the makers, who have literature available.

Lightweight Conveyor for Sand, Gravel and Stone

This conveyor has been designed, according to the manufacturer, for the small contractor, especially to handle the multiplicity of jobs he is called on to do. It looks to us particularly suited also to township, county and small city or village work, where there are many jobs that such a conveyor can perform, in highway maintenance and repairs, bridge construction, and the like. It will handle 30 to 70 tons of material an hour; belt is 18 inches wide; power is either a Stover gasoline engine or an electric motor, as desired. It should prove an economy in loading from stockpiles, or in conveying from a crusher to trucks or to a stockpile.

Like the Fords of by-gone years, this can be furnished in any color so long as it is *black*. Weight is 1750 pounds. Fuller dope from Atlas Conveyor Co., Clintonville, Wisc.

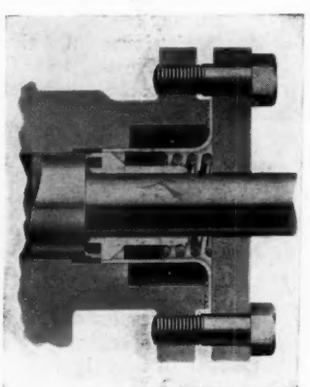
A High-Speed Excavator All-Welded of Alloy Steels

Harnischfeger Corporation of Milwaukee have announced the P&H Model 855. This is said to be the first 2-yd. excavator built with all-welded construction of new alloy steels, which gives strength and rigidity with less weight. It is fully convertible as shovel, dragline, crane or clamshell. Lightweight, all-welded booms are easily handled. Standard "live" shovel boom is 25 ft. long; dragline boom is 60 ft. long—built in two sections and is easily extended on the job.

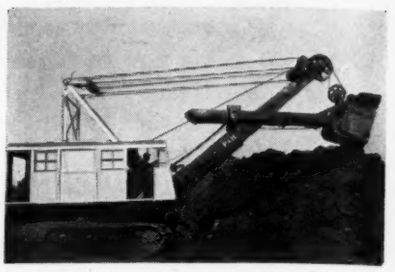
The 855 as dragline accommodates shoes of from 24 in. to 36 in. in width. To further reduce ground pressure, when particularly soft ground is encountered, provision has been made for removing the corduroy frames and extending the length of the "cats." Power is furnished by an 8-cylinder Fairbanks-Morse Diesel Engine, or gas or electric power if required. Additional information is contained in a 16-page bulletin. Harnischfeger Corporation, 4200 West National Avenue., Milwaukee, Wisconsin.

Sealing Rotating Shafts

Liquids and gases have a bad way of leaking out around pump and compressor shafts. The seal shown herewith is designed to prevent such leakage, and the illustration shows pretty well how this is accomplished. It is said to work



How rotating shafts are sealed

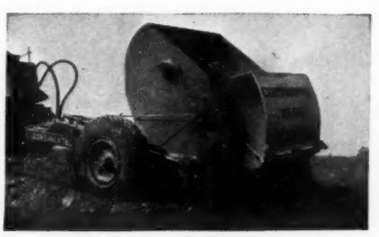


Harnischfeger Welded Excavator

as well on old, worn and scored shafts as on new ones. The seal does not need lubrication, is self-centering, self-seating and self-adjusting. It is supplied all ready for installation and is easy to install. Quietness of operation is a feature that will also appeal. Catalog and full information on request from Syntron Co., 660 Lexington Ave., Homer City, Pa.

Digs, Loads and Hauls

This 4-yard scraper is for use with 35 to 50 hp. crawler tractors, and it is claimed that it will "dig, load and haul capacity loads of tough clay, rock and tree-root-imbedded soil, shale, hardpan,



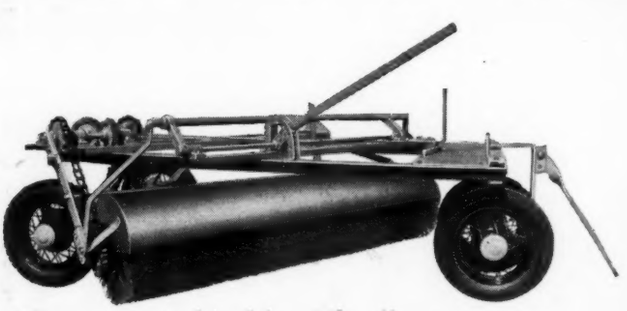
Continental 4-Yd. Scraper

etc." It has a high axle clearance, dumps by a rear gate, and has hydraulic controls with adaptors for all tractors, so you can fit it to the one you have. This unit carries the formidable term of CS4A, and is described in much more detail in Bulletin No. 107, which can be obtained on request from Continental Roll Steel Foundry Co., East Chicago, Ind.

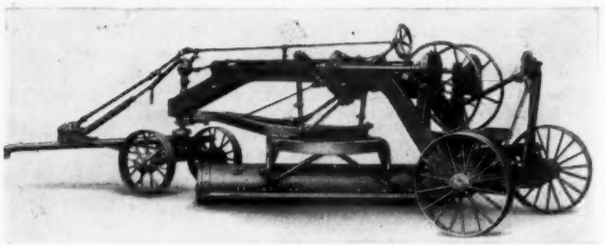
Roller Bearing Road Sweeper

This is a high-speed sweeper that can be used for keeping city streets clean (a water tank and spray attachment are available for this work) or for low-cost road construction, where clean sweeping is of prime importance. The brush is

Atlas Lightweight Conveyor



Grace Roller Bearing Sweeper



Caterpillar Medium Blade Grader

9 ft., and is driven by chains from the rear wheels. Three speed combinations are provided so that the proper brush speed is available for any work. This is a Texas product and fuller information can be obtained from W. E. Grace Mfg. Co., 1821 Chestnut Street, Dallas, Texas.

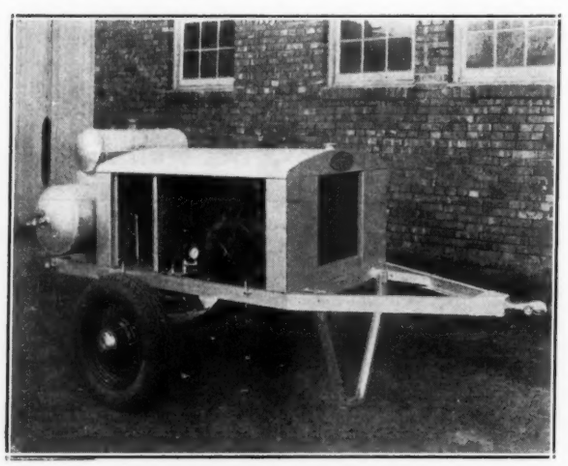
New Sullivan Industrial Compressor

The new Sullivan WN-112 air or gas compressor, in displacement sizes of 378, 480, 642 and 800 cubic feet per minute, uses modern alloys. With built-in motor, it requires only 6 feet by 8 feet floor space for any of the above capacities.

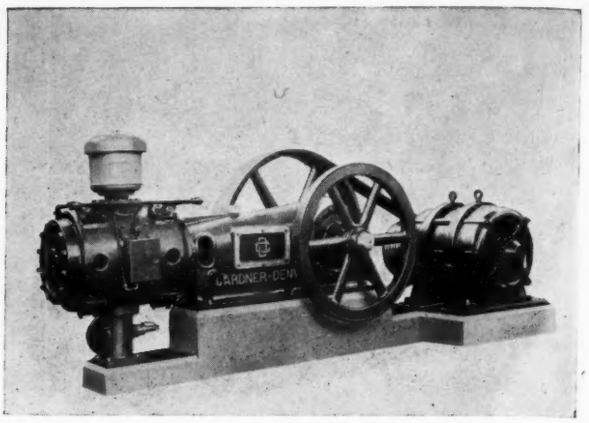
Vacuum pumps, boosters for steam or gas and low or high pressure machines are available in this new type of construction. Tests units have been in actual factory service for over a year and remarkable performance is reported. This compressor is equipped with the new "Dual-Cushion" valves.

Breaking Pavements, Drilling, Etc.

Here is another of those handy tools, so economical for many of the small jobs that the county or city has to do. This is an air compressor built around a Ford Model B engine (no used or reconditioned parts). It will deliver up to 60 cubic feet of air a minute at 110 pounds delivery pressure; at 1500 rpm it delivers 55 cu. ft. at 80 pounds. It has a self starter and batteries; it can be furnished in trailer form, as shown in the accompanying illustration, or on skids. Handy for paint spraying, sand blasting, drilling, breaking pavements, etc. Detail information from Hardsocg Wonder Drill Co., Ottumwa, Iowa.



Hardsocg 60-Ft. Air Compressor



Right, Gardner-Denver Single Stage Horizontal Compressor

A Medium Size Blade Grader

For airport construction and for highway work, a new blade grader weighing about 5900 pounds with the standard 8-ft. blade has been announced by the Caterpillar Tractor Co., Peoria, Ill. This is generally similar to the "44" and "66" graders recently announced, and is suited to tractors of about 35 hp. The manufacturers state that this grader has unusually flexible and rapid blade movements, in that the blade can be moved from a ditching position to a high bank cutting position without offsetting the blade on the beams or making any changes in the supporting links, and without causing the operator to leave his platform or stop the tractor.

Austin-Western 5-Yd. Tractor Scraper

This new tractor scraper, like its predecessor, uses but one cable and one lever to control all loading, carrying and dumping and is designed to work with any tractor within the horsepower range of 35 to 60.

Adjustments have been provided for varying the clearance under the machine and the front door is so constructed that the pan will always get a full load. Several of these machines are already in operation and users report capacities up to 60 yards of pay dirt per hour.

A new bulletin covering this latest model unit can be obtained from the Austin-Western Road Machinery Co., Aurora, Illinois.

Gardner-Denver Improved Compressor

The Gardner-Denver Company, Quincy, Ill., announces an improved single stage, horizontal air compressor, the "RX," for heavy-duty full load service and continuous operation at low power costs. This has enclosed dustproof construction without, it is said, sacrifice of accessibility, as well as accurate balance and freedom from vibration.

Another important feature is claimed to be the Electro-Pneumatic control. With this control the compressor always starts unloaded and the air supply is automatically adjusted to fit the air requirements, resulting in exceptional part-load economy. The compressors are equipped with Timken tapered adjustable roller main bearings.

Sewage Treatment Equipment by American Well Works

The American Well Works have just published catalogs of three types of sewage treatment equipment made by them —two rotary distributors and an aerator.

For filters of 100 ft. diameter or less they make a reaction type distributor, which differs from other makes of that type chiefly that it has three arms instead of the customary two or four. Their reasons are that three arms is less affected by wind than two and requires less head than four, and has perfect structural balance. These distributors are finished with either mercury or packing gland seal; the latter is recommended except where the head available is limited. The arm orifices are provided with aluminum where the head available is limited. The

Austin-Western 5-Yd. Tractor Scraper

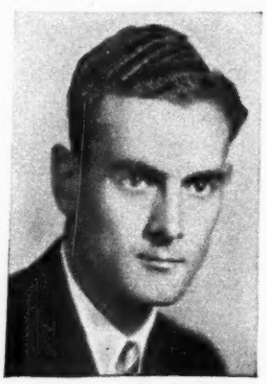
Turn to pages 55-57 for descriptions of helpful booklets and catalogs.

spreader plates adjustable both laterally and vertically, permitting securing of best spread of jets. Sizes installed since July, 1936, 47′ 6″ to 75′.

Motor-driven distributors are recommended for filters of more than 75′ to 100′ diameter because of the large starting inertia, which may cause the machine to stall or lag in starting unless there is a large dosing head or large dosing quantity. Operating by motor gives positive starting and uniform rate of rotation, regardless of head or volume of sewage. The "American" motor-driven distributor has two arms suspended from the center column by a bowstring truss. Orifices in the bottom of the arms, adjustable as to size, discharge onto a continuous splash plate. The center rotating drum is rotated around the stationary center column by a totally enclosed motor reducer powered by a cable running along the sewage feed line, the reducer driving the drum through an over-running friction clutch which protects the machine against externally applied torque and the motor against overloading, and allows the machine to be brought slowly up to speed. A 5 lb. aluminum cover on the top of the drum allows easy access to the friction clutch assembly. Since July, 1934, the company has furnished such distributors for beds from 40′ to 160′ diameter, four of the latter size having been finished in March, 1937, for Corpus Christi, **Tex.**

The "American" aerator, placed in the center of a square, round or hexagonal tank, agitates, circulates and aerates the sewage in it. It consists of a surface mixing well and a circulating pump which feeds from the bottom of the mixing well and discharges through a tube extending nearly to the bottom of the tank. The mixing well is composed of an orifice unit made up of a multiplicity of open slots, a circular wall which forms a trough around the orifice unit, and a well cone which connects the whole to the intake of the circulating pump. From the circular trough, feed troughs with adjustable weir plates at their ends radiate to draw-off points on the liquor surface. In operation, sewage flows into and through the feed troughs and the slots in the orifice unit, the sewage in which is kept about a foot lower than that outside by means of the pump. As the sewage falls into the lower level in sheets, these entrain a great number of minute air bubbles, and the mixture of sewage and air is forced down through the draft tube and ejected radially at the bottom of the tank, crosses the bottom with great agitation, rises to the surface, and again is drawn into the feed troughs, one cycle requiring about 20 minutes.

New Austin-Western Snow Plows



Burton W. Graham, who has recently joined the staff of Activated Alum. Corp., Baltimore, Md.

New Snow Plows

A new and improved line of snow plows, for use with 1-, 2- and 3-ton trucks, has been announced by the Austin-Western Road Machinery Co., Aurora, Ill.

According to the manufacturer, these plows have been designed and fabricated for better balance and greater strength; they are curved to handle a maximum quantity of snow with a minimum expenditure of power. All excess weight has been avoided to aid truck operation and permit quick and easy attachment or detachment.

The full line comprises nine models of which there are three general types—see accompanying illustrations. These include the V-type, the taper-blade type and the straight-blade type. The various types, of a given size, are interchangeable on the same underframe.

Features include rubber-tired caster wheels, cast iron runners, safety spring release and means to adjust the pitch and plowing angle of blades. New bulletins have just been issued.

W. A. Neill, recently appointed manager of engineering and sales of Worthington's Holyoke, Mass., plant

Conferences and Conventions

The 1937 Public Works Congress will be held under the auspices of the American Public Works Association, at the Atlanta Biltmore, Atlanta, Ga., October 4-6. Frank W. Herring, executive director, 850 East 58th St., Chicago, Ill., will furnish details.

The Texas Public Health Association will hold its annual meeting at the Adolphus Hotel, Dallas, Texas, Nov. 1-3. P. A. Kerby, State Board of Health, Austin, Texas, is secretary.

The Southern Vitrified Pipe Ass'n, at its annual meeting in Atlanta on August 3, elected officers as follows: President, C. B. Beasley of the W. S. Dickey Clay Mfg. Co., Birmingham, Ala.; vice-president, W. C. Boren, Jr., Pomona Terra Cotta Co., Pomona, N. C.; secretary, John M. Byrne, the Byrne Organization, Cincinnati, O.; and manager, D. M. Strickland, the Byrne Organization, Cincinnati, Ohio.

Deaths of the Month

O. W. Renkert, a leading figure in the clay products industry, died on August 6. He was president of the Metropolitan Paving Brick Co., Canton, Ohio. He was also president of the National Paving Brick Association and of the Structural Clay Products Institute.

Clifford A. Owens, president of the Osgood Co., Marion, O., died July 28. For many years he had been prominent in the shovel and excavator manufacturing field, and was also president of the General Excavator Co., the Commercial Steel Casting Co., the Alloy Cast Steel Co., The Hercules Co., the Power Mfg. Co., and the Engineering Equipment Co., all of Marion.

John A. Crook, president of the Denver Steel & Iron Wks. Co. and of the Monarch Engineering Co., of Falls City, Nebr., died recently in Omaha, Nebr.

Readers' Service Department

These booklets are FREE to readers of PUBLIC WORKS.

CONTINUED FROM PAGE 56

hole covers is eliminated by the use of Westeel rubber cushioned manhole covers and gratings. Six special advantages are explained in a new illustrated bulletin just issued by the West Steel Casting Co., 805 East 70th St., Cleveland, Ohio.

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter, crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1¼ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Large Cast Iron

408. Handy cast iron pipe and fittings catalog contains A.W.W.A. and A.G.I. standard specifications for a wide variety of cast iron pipe specialties, both bell and spigot and flanged; also dimensions Lynchburg Foundry Co., Lynchburg, Va.

Pipe, Steel

409. A very complete, 60 page, illustrated bulletin on spiral welded pipe including lots of useful engineering information, hydraulic data, flow charts, specifications, etc., issued by American Rolling Mill Co., Pipe Sales Div., 1101 Curtis St., Middletown, Ohio.

Pipe Forms

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

413. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

414. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

Taste and Odor Control

417. How, when, and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

422. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

424. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Run-off and Stream-Flow

425. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

428. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straight-line Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Setting and Testing Equipment for Water Meters

430. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

432. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

Screens

435. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Incineration

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 214 West Huron St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

453. How to avoid sludge and scum troubles in settling tanks explained in detail in Book No. 1542—has excellent drawings and photographs, also specifications. Most important are the carefully prepared capacity tables. Link-Belt Co., 307 N. Michigan Ave., Chicago, Illinois.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 570 Lexington Ave., New York, N. Y.

Water Works Operating Practices

490. This is a reprint of two excellent papers by F. E. Stuart. One outlines a number of filtration and field practices of value. The other presents a lot of kinks the author has picked up in visits to more than 1,000 water works plants. Sent free by Activated Alum Corp., Curtis Bay, Baltimore, Md.

Drawing Supplies

495. Perspective and Isometric paper, graph paper, tracing paper, blue print hangers, automatic (irregular) curves, adjustable curves, multi-purpose charting papers, etc. Write for illustrated bulletin. Wade Instrument Co., 2246-PW, Brooklyn Station, Cleveland, Ohio.

For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

How to Cut Cast Iron:

This 8 pp. booklet presents the procedure for cutting cast iron with the oxy-acetylene process. In spite of the fact that correct and satisfactory methods for cutting cast iron have been known for some years, the tradition has persisted that cast iron could not be cut with the oxy-acetylene flame as steel can. The booklet sets forth clearly how this is done. The technique is described in a step-by-step way. This description is supplemented by a full page of sketches that show the various steps clearly. Ample illustrations add to both the text and the sketches. The equipment necessary, a comparison with steel cutting, how the quality of the casting affects the manipulation and technique, safety precautions to be observed, and the metals other than cast iron that can be cut by this same method are all discussed. Copies free.

City Codes Compilation:

A new building code manual has been published by the city of Miami, Fla., in cooperation with the WPA. This covers every conceivable phase of building, including materials, street occupancy during construction, classifications, zoning, heights of buildings, etc. It is indexed and cross-referenced. Printed on thin paper: 525 pp. plus maps and illustrations. Not for general distribution, but doubtless city officials desiring a copy can obtain one by writing the mayor.

Smoke Regulation:

Regulations covering smoke control in Jersey City have recently been revised and issued as a 19-page pamphlet. These regulations are in considerable detail and cover (a) power boilers; (b) portable equipment; (c) heating boilers; (d) warm air furnaces; (e) incinerators; and also water heaters, locomotives, ships, manufacturing plants, etc. They are intended to be a guide for owners and to insure that new construction and changes shall be done in such a manner as to cause no smoke nuisance. The Jersey City work has been outstanding. W. S. Christy, smoke abatement engineer, Courthouse, Jersey City, N. J., writes he will be glad to furnish copies of these regulations for 6 cents in stamps.

Well-Point Facts:

Most of this 20-page booklet is devoted to illustrations showing how well-points are used for dewatering ground so that construction can proceed dry. There are also several pages of typical layouts showing how the well-points are actually installed and used to pre-drain the ground before construction. Griffin Well-Point Corp., 725 E. 140th St., N. Y., will send this on request.

Diesel Engines And Their Lubrication:

This is Vol. 1, No. 4, of the "Panorama of Lubrication" issued by the Shell Petroleum Corp., St. Louis, Mo. A marvelous presentation in 4 or 5 colors of how a diesel works, its efficiency and use. Complete data on 2 and 4-cycles, compression ratios, speeds, ignition, fuel injection, and other items; on semi-diesels; on operating principles. One of the best texts—and the most interesting the reviewer has yet seen, and the most interestingly presented 48 pages. If you want a copy, write the Engineers' Library, c/o Public Works. We believe we can get you a copy without charge.

Steel Water Mains:

A 120-page manual about Youngstown spiral wrapped and lined steel water mains, with technical information for engineers. This is in loose-leaf form, with permanent binder, to facilitate the addition of data on pipe, fittings, laying methods, etc. (which additions will be sent out from time to time). Many useful tables and charts covering basic hydraulic information and engineering data used in water main flow capacity and pipe line computations. Subjects discussed include records of service of steel pipe in water mains, laying methods, corrosion, tuberculation, incrustation, leakage and breakage factors, carrying capacity, cleaning and sanitation, coating and wrapping, linings, couplings and joints, fittings and service connections, and other useful data. Copies on request to the Water Works Division of The Youngstown Sheet and Tube Company, Youngstown, Ohio.

INDEX TO ADVERTISEMENTS